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The ELECTRICAL REVIEW

FOUNDED 1872

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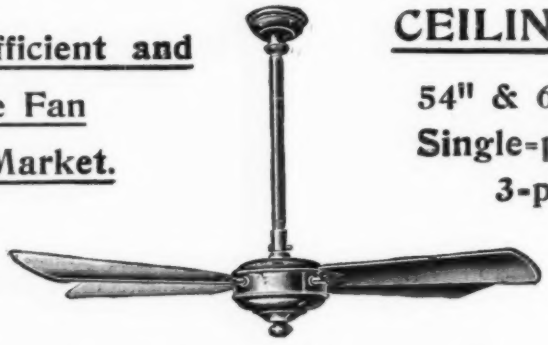

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The Birmingham Controversy.

WE suggested in a leaderette a fortnight ago that municipal attacks upon groups of electrical manufacturers who were suspected of profiteering at the expense of the public should not be left unanswered. We therefore feel that the B.E.A.M.A. as an organisation has done the right thing in answering the charges that were made against it in the speech of Mr. Beale, the chairman of the Birmingham Electric Supply Committee (ELEC. REV., June 13th, p. 985). We publish the full answer of Mr. D. N. Dunlop, the Director of the B.E.A.M.A., elsewhere in this issue, along with some comments made thereon to the Birmingham daily Press by Mr. Beale. Readers will remember that in February last, when the Bradford Corporation was engaged in a controversy respecting the converter contract, Mr. Dunlop, at our invitation, stated the case for the manufacturers in an article entitled "Prices of Electrical Plant" (ELEC. REV., February 29th, p. 331).

Careful reading of all these contributions to the subject will have familiarised the reader with the main points that are at issue; we have no wish to waste words in summarising facts and arguments already recorded. Comment is required, however, on one or two points. Mr. Beale, in his speech, stated that the equipment quoted for in the tenders of the four firms "in the ring" was "almost identical"; though there were "some slight differences in detail," they were "substantially the same plant." Mr. Dunlop, in his letter, replies that this is far from being the case. He says that the switchgear being supplied by the existing contractor is "entirely different" from that required by the specification issued to the tenderers for the present requirements. One is "standard" to them, and the other is "experimental," and the difference in cost of the two designs "justifies the difference in the prices." In some particulars the switchgear specified is such as

has never been manufactured up to the present, involving the development of special methods of construction and insulation; it is described as requiring extended experiment involving considerable financial risk to those having no previous experience with identical gear. Mr. Dunlop states fundamental points of difference.

Mr. Beale was not unnaturally exercised in mind by the fact that the existing contractors, when permitted to quote, put in a price in the same neighbourhood as the tenders submitted by the four grouped firms (£9,360), but they were willing later to carry out the work as an extra on their existing contract for £3,615. Their ability to do so with profit might well be questioned if the work that they agreed to do for £3,615 was identical with that in the specification, but, as already mentioned, Mr. Dunlop states that it was not so. Among other questions that might be asked is: Will the equipment to be provided "as an extra" for £3,615 be so made as to stand the 100,000-volt insulation test?

It should not be difficult for those who have all the documents before them to decide who is right and who is wrong. Unfortunately in this case, as in too many others, the particulars of the tenders received have not been made accessible to the Press, though it used to be regarded as necessary in the public interests that such matters should be afforded full publicity. While, however, we have no information at our command beyond the two opposite statements, we are not prepared to accept such material as has been vouchsafed as evidence of "profiteering" either by the group concerned or by the members of the B.E.A.M.A. generally, and on that important point we think Mr. Dunlop is entitled to ask for false impressions to be rectified.

We have too sad a memory of the state of affairs that existed in the electrical industry before its principal members came together in an organised association, to be able to contemplate with equanimity a return to that policy of individual action where unrestricted competition weakened everybody financially, technically, and morally. Experience has proved that it is in the best interests of the industry that concerted action of separate groups within a more or less complete body should prevail. A return to open competition would mean ruin to the majority of the larger concerns, and we should once again have to face a period in which there would be no dividends, capital reductions, liquidations, and so forth, thus reducing the number of tenderers until those remaining would again be driven to arrive at an "understanding" to save themselves.

Municipal engineers know quite well that it is far more satisfactory to carry on business with a financially sound contractor than with one of doubtful stability. And if we are not mistaken, business men of such a city as Birmingham will not be slow in appreciating the importance of an industry being secure, and in recognising that there are trades in which, at present at any rate, security can only be obtained by the adoption of some system for fixing prices.

It is common knowledge that in certain sections of the electrical industry, to some extent, prices are agreed upon, but the mere existence of such a state of things does not justify charges of profiteering in those particular sections; much less does it justify an attack upon the Association as a whole. In earlier days manufacturers tried to form themselves into small groups to prevent any member of their class from putting in a ruinously low price and so spoiling the business for everybody, but the groups seldom hung together for long. The organisation of the industry may have placed them in a better position to secure that end. The principle of co-operation for which the B.E.A.M.A. stands, would naturally make that body sympathetically disposed toward such action on the part of a group.

Yet it is not wise to overlook the fact that the fixing of prices, whether they be for household commodities or for electrical equipment, is bound to give rise to suspicion that somebody or other is being "done" unless that price-fixing be subjected to control in some shape or form. It has been suggested that the B.E.A.M.A., as a whole, should control the price-fixing, any serious case of complaint as to unduly high prices being brought before the whole Council for investigation, and not merely left to be dealt with by the group concerned. This is worthy of consideration, though we can conceive of cases arising where, as at Birmingham, the entire body will become the object of criticism and attack instead of the group or groups of firms that put in a price which somebody thinks excessive. In the present case Mr. Dunlop, as director of the organisation, has performed a useful service by calling for the documents and writing to the Town Clerk of Birmingham, explaining the B.E.A.M.A. position and detailing the case on behalf of the group.

If we have come to the point where there must be arbitration as to the fairness or otherwise of a number of quotations, we cannot look to the purchasers as represented by the I.M.E.A. or the Birmingham Corporation, or to the manufacturers, as represented by the B.E.A.M.A. "One man's word is no man's word: justice needs that both be heard!" And who shall hear them? Somebody with authority to call for the complete story and qualified to adjudicate upon the statements of the parties.

Assuming the impracticability of the general body of manufacturers being in a position to decide upon the fairness or otherwise of one of its small but possibly powerful groups; assuming also the unwillingness of the public to accept the finding of a body of manufacturers regarding the action of a section of its own members, even if it were possible; and assuming the unwillingness of B.E.A.M.A. firms to accept the ruling of the I.M.E.A.; can the situation be met, so far as the controversy affects municipal contracts, by setting up a joint adjudicating committee elected by the two bodies, presided over by a man of unquestionable impartiality?

The I.M.E.A. Convention.

THE Incorporated Municipal Electrical Association is to be congratulated on the completion of one of the most successful Conventions in its history, and the retiring President, Mr. S. E. Britton—who ascribed at least half of the success to Mrs. Britton's efforts—may justly enjoy the satisfaction engendered by that fact. Great credit is due also to the officers and staff, honorary and otherwise, especially Mr. A. C. Cramb, hon. secretary, and Miss Lanfear, secretary, for the efficiency and thoroughness with which the arrangements were drawn up and carried out. So far as we are aware, not a single hitch occurred for which they could be held responsible, and even the weather, somewhat unstable on the first day, was on its best behaviour for the rest of the week.

The programme, though quite full enough, was not unduly burdened with either work or play, and the papers were of a high order; it would have been well,

however, if one of the technical papers had been replaced by one dealing with the commercial aspect of electricity supply, which on this occasion was touched upon only incidentally in the discussions and after-dinner speeches. It is so fully recognised nowadays that the chief function of the manager of an electricity supply undertaking is to sell electricity, and to sell it all the time and to everyone, that the omission of a session devoted to this subject was distinctly regrettable. In view of the presence of so large a proportion of chairmen and committee-men at this year's meeting, the opportunity of pressing home on them the urgent need for liberal expenditure on advertising electricity, on showrooms, and on efficient salesmen, ought not to have been missed.

The technical papers by Messrs. Miles and J. N. Waite were full of valuable information, and their merits were justly recognised by the award of premiums. Councillor W. Hammer dealt with administrative matters, and rightly emphasised the fact that "service" is the keynote of electricity supply. The importance to the community of the extension of the use of electricity in every department of modern civilisation cannot be over-stressed. We are pleased to see that he is opposed to the draining of the life-blood of an electrical undertaking—namely, the capital derived from its surplus revenue—for the relief of the rates. The only justification for that practice is the possibility that the rates may be drawn upon to meet a deficit on the year's working, but nowadays that is a remote contingency, and should not occur. We have for a quarter of a century contended that the business should be run on commercial lines, and that relief of the rates is no part of the functions of a public supply undertaking. Parliament has in some cases explicitly adopted this view, and, as Councillor Hammer remarks, the practice of bleeding the undertaking is falling into disfavour. We also have urged in these columns that the right course is to get a good engineer, pay him well, and let him manage the business without undue interference, and we are glad to find ourselves in agreement on these and other points with the Mayor of so enterprising and up-to-date a borough as Hackney.

The Transverter.

IT has long been the aim of designers to produce a machine that will generate direct current at extremely high pressure—an object which has now been realised by Mr. W. E. Highfield and Mr. J. E. Calverley. Their invention, which is described elsewhere in this issue, is an extraordinary device that will, no doubt, be the subject of a great deal of controversy; it was designed with the primary object of converting alternating current of normal voltage and periodicity into direct current at a voltage sufficiently high to permit it to be used for transmission purposes. From the points of view of the generation and distribution of electricity alternating current has undisputed advantages, but one has become so accustomed to three-phase transmission that the superiority of d.c. for that purpose is apt to be overlooked.

If the transverter will enable the benefits of d.c. transmission alone to be realised, it will justify itself. Other applications of the apparatus are, however, readily instanced. Besides being reversible, the device will convert d.c. of one voltage to d.c. of another; the transverter is thus probably destined to be of outstanding importance in the electrification of railways. It has been estimated that its use, instead of the normal substation machinery, will save something like 50 per cent. of the cost of such equipment, and by enabling the e.h.p. transmission system to serve both industrial and railway needs, the economic aspect of railway electrification will be considerably assisted.

Moreover, the new machine should be of considerable utility in the interconnection of networks, for it will enable a d.c. link to be made between two a.c. systems of different frequencies, while a still further use is in meeting the demand of radio engineers for a source of h.p. d.c. On the whole, therefore, there seems to be good cause for predicting that the transverter will be a success; it is not a rotating machine, and may accordingly be built in a very robust form. Further, as centrifugal force does not enter into the design of its main components, the designer is free to concentrate upon the electrical performance; the efficiency of the 2,000-kW plant on view at Wembley is of the order of 95 per cent.

In conclusion, credit is due to the English Electric Co., Ltd., for courageously undertaking the costly experiments necessitated by the construction of such apparatus; by so doing, it has shown commendable reliance upon the ability and experience of its staff. In these days, when it seems to be an established custom to wait for inventions to be developed abroad and then acquire licences to produce them in this country, a practice with many harmful results, it is refreshing to know that such a notable advance in electrical engineering is entirely British in conception, design, and construction.

A Trade Inquiry and an Electrical Policy.

IN our leading article of May 30th we commented upon the attitude taken up by Mr. Sidney Webb, President of the Board of Trade, with reference to an inquiry into the state of our trade and its future prospects. A promise was then given that "the next day or later" a statement bearing upon the form of inquiry and the *personnel* of the committee would be made. Well, it was not made next day, and it is now more than a month "later," yet nothing that can be described as a "statement" has been forthcoming. Perhaps we should not have expected anything better from one who showed such reluctance. The question was raised in the House of Commons last week on the Board of Trade vote by Mr. Lloyd George and, according to *The Times* report, Mr. Webb replied that "the Government had decided to have such an inquiry, and at the earliest possible moment an announcement would be made as to its scope and *personnel*." Mr. Lloyd George covered a good deal of ground that is very familiar to our readers already about the re-equipment of German factories since the war, and said that "since 1913 we had made less progress in regard to electrical power than any other great trading country." Germany before the war "had less power at her command than we had, but she had since increased it in spite of the fact that one third of her coal had been taken away." The figures upon which he relied are given in our "Parliamentary" Notes on p. 1038. To this point Mr. Webb is reported to have replied that there were directions in which the Government could do more, perhaps, than in equipping factories. "*He thought they could see their way to give a push onwards to electrical development.*" We have heard so many suggestions from politicians who are taking electricity under their wing that this one leaves us as unmoved as any that have preceded it, though perhaps a little more curious. Anything that will accelerate the rate of electrical development here or anywhere else will be heartily welcomed, and anybody who can do anything fair and reasonable and substantial to remove the obstacles that stand in the way of progress will deserve the gratitude of the nation, but we tremble at the prospect of electricity being played with for political ends. How many legislators have we who have a real grasp of the electricity supply situation in the United Kingdom? And we would add how many electrical men are there who, as they face the trade situation to-day, believe that the difficulties of that situation will be removed by the adoption of a new political policy promising cheaper electricity? So far as the politician is concerned, perhaps it is as well that words should be the end of the matter. Electricity supply will make a better showing if left to itself under the guidance and control of the Electricity Commissioners.

D

The Wembley Exhibition Colliery.

A Realistic Working Exhibit.

(*Concluded from page* 1011.)

Underground, in addition to the usual manager's office, ambulance room, &c., there are stables containing live pit ponies and an example of pony haulage, in contrast to which Messrs. Joseph Booth & Bros., Ltd., supplied a No. 2 "Union" electric locomotive, fig. 11. The vehicle is built for an 18-in. rail gauge to withstand rough usage; its special features are that it is fitted with spring buffers, all gears are enclosed, and

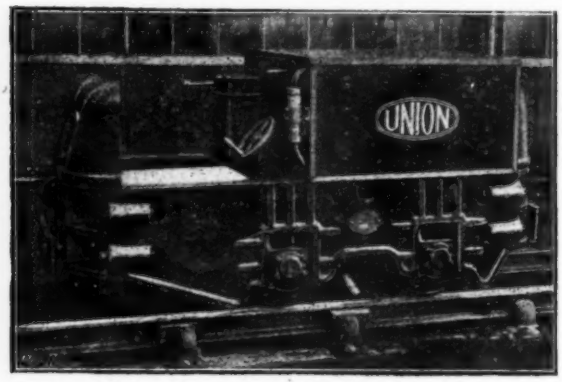


Fig. 11.—Booth Battery Locomotive.

both pairs of wheels are worm driven. Involute springs are fitted to each wheel and ball bearings used throughout. The drum controller gives four speeds in either direction. The example exhibited is provided with a D. P. "Kathanode" 216-amp.-hour battery. Messrs. Booth are also showing in the lamp room a motor-generator and battery-charging panel.

worked by hand. No. 2 face is a similar seam undercut by means of a Mavor & Coulson "Samson" disk cutter, fig. 12, and loaded out by hand. The electric cutter is intended to show the efficiency of machine holing to moderate depths in the hardest cuttable materials when the conditions favour the use of such devices.

No. 3 is a 3-ft. seam worked by hand, but the face is equipped with a "Meco" belt conveyor supplied by the Mining Engineering Co., Ltd. The 20-in. belt is driven by a 7½-h.p. motor, and on the driving head are mounted three drums and a gear box. Speed reduction is accomplished by means of thrustless balanced worm gears running in oil, while the lower belt is kept clear of small coal on the tension drum by a brush driven by skew gear. The woven cotton belt has a life of several years; these conveyors can be made with capacities up to 70 tons per hour, and are suitable for lengths up to 200 yds. They will work equally well up or down hill, and the power needed to drive a 100-yard conveyor is about 4 h.p.

No. 4 face is a 3-ft. seam of coal undercut by a chain cutter, and loaded on to a conveyor, both of the "Diamond" type and operated by compressed air.

No. 5 face is electrically worked by Mavor & Coulson machinery; the 2-ft. seam is undercut by a 3-phase "Baby" machine at the floor level, with a cutter bar 4 ft. long, similar to the overcutter shown in fig. 13; it is assumed that the seam is friable so that a disk machine, if used, would be jammed by the falling coal, and a chain cutter would pull the coal over and churn it into "smalls." The coal cut is loaded by the fillers on to a shaker conveyor to the loading road at the end of the face. As it was inconvenient to accommodate in the roadway electric shaking

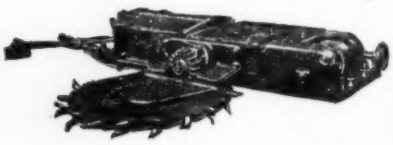


Fig. 12.—"Samson" Coal Cutter.

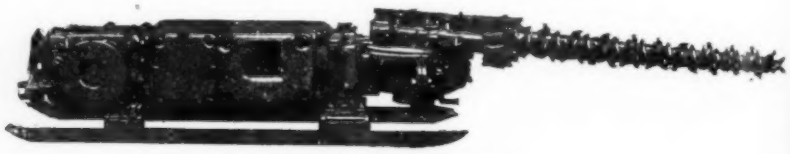


Fig. 13.—Bar Coal Cutter.

Two patterns of electrically-driven haulage engines are shown, one being an endless-rope Markham engine, driven by a Brook 30-h.p. 720-r.p.m. motor, and the other an M. B. Wild main-and-tail 25-h.p. hauler driven by a G.E.C. motor; the latter is fitted with roller bearings throughout, has drums 2 ft. 6 in. in diameter, and Brunton's ropes are used. The portable Broom and Wade underground air compressor, capable of delivering 130 cu. ft. per minute, is driven by a Brook 22-h.p., 360 r.p.m. motor, while the two sets of pumping plant are also electrically driven. One of them is a six-stage turbine pump by Messrs. Holden & Brooke, and the other is a Pearn three-throw ram pump capable of dealing with 9,000 gals. per hour at a head pressure of 60 ft., being driven by a G.E.C. motor of 45 h.p. at 720 r.p.m.

At the coal faces figures of miners and boys, each represented as performing the work he would do in a mine, give an excellent idea of how the work is actually carried out. Five types of long wall workings are shown. No. 1 face is a seam of coal 4 ft. 6 in. thick

gear with rope transmission, low type driving gear, fig. 14, was installed within the height of the seam and coupled direct to the conveyor trough. The height of the gear is only 1 ft. 9 in., and the details of its attachment to the conveyor, together with the normal arrangement at the face, will be understood from the diagrammatic plan and elevation, fig. 15.

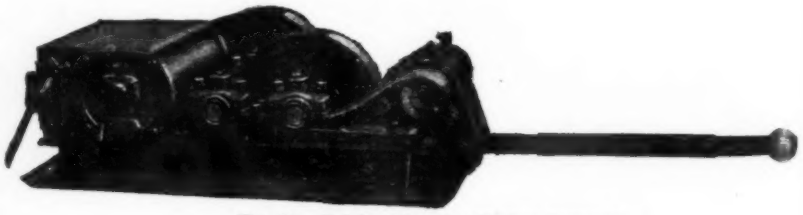


Fig. 14.—Driving Gear for Shaker Conveyor.

This gear delivers the coal on to a standard 3-phase gate-end loader, the coal being carried by the endless scraper chain up the inclined portion to the horizontal length which is above the height of the tramcars into which the coal is discharged.

A Climax drill shows how a heading is driven in hard rock; a Siskol machine indicates how a heading is

driven in coal, and a Holman stretcher bar hoist and a Markham's portable hoist illustrate how tubs are pulled out of steep places. Messrs. Matthias Spencer & Sons supplied all the miners' tools, including picks, hand drills, &c., and the "Rensha" prop removers and "Klippa" chain retainer. Messrs. Nobel Industries, Ltd., demonstrate how electric shot firing is done, and the use to which explosives are put for breaking down hard ground and shooting down coal. Shot holes have been made in appropriate positions underground with dummy explosives, detonators, and firing apparatus in position.

A complete telephone and signalling system has been provided by the Sterling Telephone & Electrical Co., Ltd., with switchboards below and above ground, so that communication can be established between all points. Messrs. W. Francis & Co., Ltd., of Manchester, have installed an entirely new system of "universal" electric lighting. The fitting is constructed in two parts, as shown in fig. 16; the first portion consists of a terminal box split in such a manner as to enable

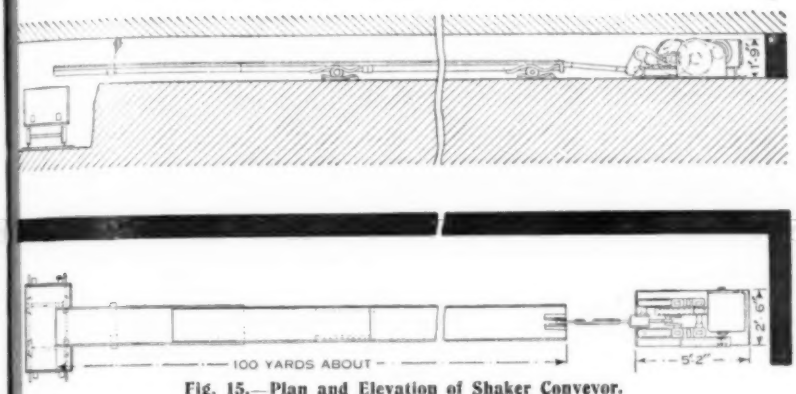


Fig. 15.—Plan and Elevation of Shaker Conveyor.

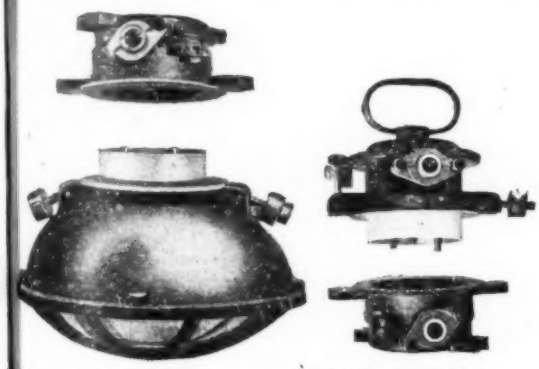


Fig. 16.—Francis "Universal" Lighting Fitting.

connection to be made without cutting the cable, which is bared in two places and attached to the terminals; the box is then assembled, and may be compound filled. The second portion contains the lampholder, lamp, and plugs, and is arranged to plug into the switch end. A double-pole double-fused plug switch works in conjunction with the fitting, and is interchangeable with the above-mentioned second portion of any terminal box. It is impossible to plug in or withdraw the switch when it is in the "on" position, neither can the circuit be made or broken slowly.

Thus, so far as space has permitted, everything essential for working a colliery is exhibited, illustrative of a variety of mining methods, with a representative display of British plant. Well over 100,000 people have already visited the mine.

Electrical, &c., Exhibition at Magdeburg.—From August 3rd to September 14th a great gas, water and electricity exhibition will take place at Magdeburg. Among others there will be sections devoted to the use of electricity in kinematograph and radio apparatus, public lighting, and illuminated advertisements.—*Reuter's Trade Service* (Magdeburg).

A Super-Sensitive Circuit for Broadcast Reception without an Aerial.

By G. G. BLAKE, M.I.E.E., A.Inst.P.

THE employment of an aerial is in many instances a serious set-back for those wishing to enjoy the privileges of broadcast reception. Those, for instance, living in hotels or flats at a distance of 15-20 miles from the nearest B.B.C. station are either obliged to stretch untidy-looking wires across their rooms or use frame aerials and elaborate multivalve sets. With the object of finding how far these difficulties could be overcome, the author has been experimenting for some time past. He found the simplified Flewelling 1-valve circuit, working with an earth connection only, very efficient. Twelve miles from London music, &c., could be heard clearly, though not very loudly, across a room from a loud-speaker.

There was always present, however, the objectionable Flewelling whistle produced by the quenching of the self-oscillation of the set by means of condenser charges. If the reaction between the plate and grid circuits was reduced until this whistle ceased, music and speech were still easily readable in the head-phones, although the set was no longer functioning as a Flewelling receiver.

After many experiments with various forms of variable grid-leak, including air ionised by radioactive spirals, and also various ways of connecting the set to earth, the following method was finally adopted, and proved to give super-sensitive results. Using only one valve and head-phones, an earth connection, and no aerial of any kind, London, Bournemouth, Birmingham, and Cardiff were all received. London came in very little, if any, weaker when received in this way than when received on an ordinary one-valve regenerative set employing a good P.O. aerial. Although the arrangement about to be described is super-sensitive when the grid is connected to earth and no aerial employed, it answers very poorly with an ordinary aerial and earth. Fig. 1 shows the arrangement.

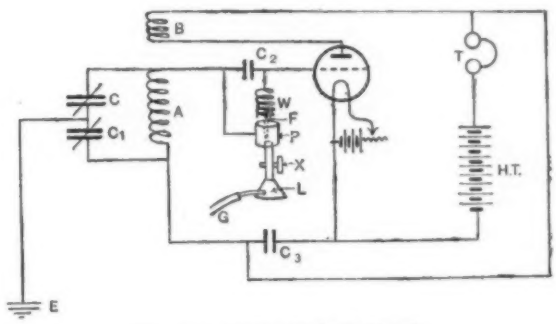


Fig. 1.—A Super-sensitive Circuit.

A is the aerial tuning coil and B the reaction. For this purpose any make of plug-in coil will do, or both coils can, if preferred, be wound by hand on one cylindrical former, at a suitable fixed distance from one another, and the coupling can then (as we shall see later) be controlled by means of a variable condenser C of 0.0005 μF capacity. C_1 is a second variable condenser, of the same capacity, which is used for tuning. These condensers are connected in series with each other across the ends of tuning coil A, and a connection to earth (to a gas or water pipe) is made between them as shown in the figure.

The grid resistance C_2 is of 0.00025 μF. From the side of this condenser nearest to the grid is suspended a small spiral of stout copper wire W. L is a small gas burner supplied from an india-rubber pipe G and controlled by a tap X. This should be connected to an ebonite control arm (not shown in the figure).

Around the flame, which need only be a very small one issuing from a pin-hole, a small cylinder of metal P is arranged. This is insulated from the burner and flame, and is connected to the other terminal of the grid condenser C_2. By arranging so that the burner projects a short distance into this cylinder (without touching it) it acts also as a windscreen for the flame. The leak is caused by the ionisation of the air in the neighbourhood of the flame, and regulation of the gas supply gives very good control. It was feared that the arrangement would be so easily disturbed by the least breath of wind that it might prove unpractical as a grid leak; this, however, did not prove to be the case, slight puffs of air made no appreciable difference. The reason for this is probably the fact that the flame ionises the air for a very considerable distance, an actual draught being necessary in order to clear away the cloud of ions.

C_3 is a small condenser as employed by Flewelling, having a capacity of 0.006 μF. The object of this condenser is not in this case, however, to quench the self-oscillation of the set. It is employed to insulate the grid so that it may be connected to the positive terminal of the h.p. battery, connection being made from the grid side of condenser C_3 to the telephones T as shown.

The grid being held at earth potential, the rest of the set is therefore made relatively more negative, so that the valve is caused to function near the top of its characteristic curve.

This can be at once shown by inserting a milliammeter in the plate circuit, when a plate current reading of from 0.5 to 1.0 mA can be obtained before the arrival of any signals.

Two types of effects can now be obtained with the set.

(1) If a comparatively large value coil be employed for reaction and coils A and B are tightly coupled, the true Flewelling effects can be obtained. Condenser C_1 by repeatedly charging and discharging, will quench the oscillations and produce the well-known Flewelling whistle, full control of which is given by adjusting the gas flame.

(2) If only a comparatively small value of inductance is used for the reaction coil B, the coupling can be definitely fixed at a point where the set is just not oscillating when condenser C is set at about three-quarters of its capacity. Under these conditions it will be found that the reaction of the set can be perfectly controlled by small variations in the capacity of condenser C and the various stations can be tuned in by means of the condenser C_1.

In using the set in this way it should be remembered that the capacity of condenser C must always be large in relation to the capacity of condenser C_1, which should be as small as possible. Therefore, in selecting coil A, a coil having as large an inductance as possible, consistent with the wave-length to be received, should be chosen.

The action of the set can sometimes be made more reliable by connecting a high-resistance leak (say, of about 50,000 ohms) across the terminals of condenser C so as more effectively to anchor the grid to earth potential.

The filament and plate circuits of the set really take the place of the usual aerial, and during reception the potential of the set continually fluctuates below and above that of the grid, which remains constant. This is the reverse of the action of a set which is itself earthed and has its grid connected to an aerial.

An ordinary R valve answers quite well, using a plate voltage of only 45 volts.

Another (but not quite so effective) method of connecting up the set is to use only one variable condenser across coil A and to connect the grid direct to earth. In this case, of course, reaction must be controlled by adjusting the distance between coils B and A.

The London-Bristol Telephone Cable.

First Independent Repeater Station.

THE London-Bristol telephone cable, which was brought into service on June 2nd, 1924, is one of the main links in the network of underground cables which is now being laid all over the United Kingdom. This network will gradually replace many of the overhead road lines and will fulfil promises given by the Postmaster-General and his predecessors to provide in this country a telephone system which shall be almost immune from interruption by winter storms and gales, to which the overhead line system has always been subject.

The network was really inaugurated by the laying of the cable from London to Birmingham and Liverpool, which was put into service during 1916, but construction work was practically at a standstill during the war and the next link of the main underground system to be put into service, *viz.*, the London-Manchester cable, was not completed until 1921.

The London-Bristol cable follows the Bath Road route practically the whole way. The cable contains 616 wires encased in a lead sheath with an overall diameter of about $2\frac{3}{4}$ inches. The wires are "loaded" at intervals of 2,000 yards with inductance coils (3 coils for each group of 4 wires). The coils are encased in cast-iron boxes placed in ferro-concrete chambers below the road surface. The cable itself is drawn into an earthenware duct, and provision has been made for two ducts along this route.

The 616-wire cable provides a total number of 462 channels of communication. The total weight of copper per mile of cable is approximately $5\frac{1}{2}$ tons. It may be noted that the same amount of copper would provide, on an overhead road line, only 60 wires of average conductivity.

The cable is divided into three sections by the repeater stations at Taplow and Marlborough. These repeater stations are, in effect, power stations for amplifying and relaying, by means of thermionic valves, the current transmitted from the terminal telephones. The main underground network is divided generally into sections, known as repeater lengths, of approximately 50 miles.

The London-Bristol cable will be the channel for communication between London and the West of England; but the network has been so designed that in the event of a breakdown on, say, the London-Birmingham cable, communication between London and Birmingham will be maintained *via* Taplow, Marlborough, Bristol, and Gloucester. The completion of the cable will also enable direct communication to be established for the first time between London and Plymouth. The large number of line circuits provided by these modern underground cables has made it possible for the Post Office to provide the public with a very rapid service between large commercial centres.

The London-Bristol cable and all the main links of the underground network contain a number of lines specially designed so that in due course they may form part of a European international underground network

of telephone communication channels, on the lines discussed at the recent conference in Paris.

The Taplow repeater station is the first to be completed of a series of large independent repeater stations designed for operation in connection with the national and international services. The comparatively large installations of telephone repeaters on the London-Manchester cable at Fenny Stratford, Leicester, Derby, and Manchester are, in effect, not more than temporary installations provided as an interim expedient until the many difficult problems, which had to be solved before the large independent stations could be constructed, were worked out. That at Taplow will be followed by other similarly independent stations at various points of the network.

A modern first-class telephone repeater station is an independent electric power station combined with an equipment consisting of some of the most delicate apparatus used in telephony. The Taplow station is a red brick and ferro-concrete building of two floors, each floor having an area of about 5,000 square feet; it has been so designed, and the site planned accordingly, that an extension to twice its initial capacity can be made. The lower floor of the repeater station contains the power plant; the upper floor the amplifying elements associated with the lines.

The power plant consists of 75-h.p., horizontal, cold starting, airless injection, oil engines designed to work normally on the heavy residual petroleum known as semi-Diesel oil, but capable, should the necessity arise,

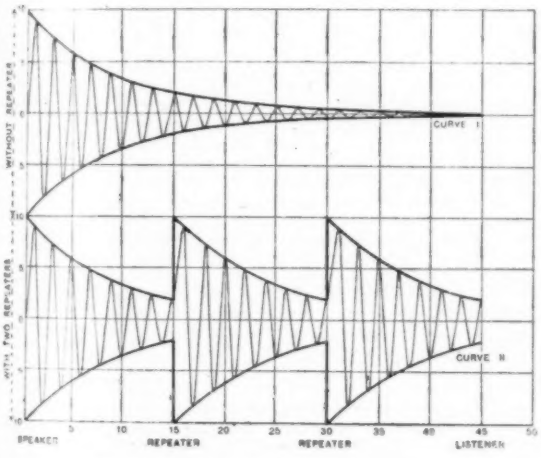


Fig. 1.—Effect of Telephone Repeater.

of working on the lowest-grade residual oil, known as furnace oil. The engines are of the low-speed type (210 r.p.m.), and are practically silent when running. They are coupled direct each to two generators in tandem, the combined output of which is 50 kilowatts. One generator provides current at a pressure of 22-30 volts for charging a set of accumulators, called the "A" battery, which has 11 cells with a total capacity of 10,000 ampere-hours and supplies the heating current for the filaments of the thermionic amplifiers.

The second generator on each engine shaft supplies current at a pressure of 150 volts for charging a set of accumulators, known as the "B" battery, used for lighting the whole station and for running various auxiliary motors, such as cooling-water circulators, ringing machines, fans, vacuum cleaners, air compressors, &c. The "B" battery consists of 75 cells with a capacity of 300 ampere-hours and its principal function is to supply the relay current to the amplifiers. The "A" and "B" batteries are in duplicate.

The power control board, which is of the usual power station type, controls all the generator, motor, and battery circuits. The upper floor of the station accommodates the telephone repeaters, the cable termination, and the test desk. The vital element of the repeater is the thermionic valve, so familiar to amateur radio telephonists; but there are important differences in design between the repeater and the receiving valve, principally in respect of power output, life, and constancy of characteristics. The severest requirement for a telephone repeater valve is that it shall not differ by more than a small percentage from a specified list of characteristics. A percentage difference between the valves of a radio receiving set, which could hardly be detected and would make no difference whatever to the functioning of the set, would make the design of a telephone repeater to meet modern requirements impossible. Happily we have at our disposal in this country a telephone repeater valve which is believed to be second to none in the world. It has been evolved after long and arduous research work by the Post Office engineers, assisted by the research establishment of the General Electric Co., of London, and is so well made that it is possible to change a valve on any repeater without affecting, in any way, its amplifying constants. The average life of this type of valve is six months' continuous operation and, during this period, it will dissipate a total energy of approximately 18,000 watt-hours.

Curve 1 (fig. 1 top) shows how the current in a telephone circuit is attenuated as the speech wave travels along the line, while curve 2 (fig. 1 bottom) shows the effect of introducing a repeater, or speech amplifier, at the points marked. It will be observed that the amplitude, or strength, of the current received for the same current sent into the line by the talker is much greater in the second case. The effect of the repeaters is, in fact, to increase the energy received about 600 times. In the case illustrated in curve 1 speech would be just possible, whereas in that illustrated in curve 2 very good speech would be obtained over the circuit. The length of the line is shown in terms of transmission units; one unit being equivalent to about six miles of a loaded underground circuit.

The repeaters, which are mounted on steel plates with an area of about 2 sq. ft. each, are supported on vertical section steel racks which carry five repeaters in each vertical section. One repeater, with its associated iron-core transformers, filters, and ringing relays, weighs about 200 lb. Eight groups of five repeaters make up one bay, and each bay is provided with apparatus controlling the current supplied to the valves and relays.

Each circuit in the main cable is terminated on a transformer at one end of the repeater room. The transformers, which are mounted on steel racks, are connected with the repeater bays by lead-covered cables each carrying a number of copper conductors insulated with a silk and cotton mixture. Between the terminating transformers and the repeater rack, the connecting cables are led through a distributing frame where any particular circuit can be entered for testing or other purposes.

The testing equipment of a repeater is of quite a special nature and consists of (*a*) a sensitive reflecting galvanometer equipment for routine testing the main cable; (*b*) high-frequency alternating-current testing equipment for maintaining a constant check upon the operation of the repeaters themselves when associated with the line; and (*c*) an alternating-current Wheatstone bridge.

Hygrometers for maintaining constant observation of the conditions of the atmosphere are essential items in a repeater station. It is necessary to maintain a very high degree of insulation and means are provided for controlling the condition of the atmosphere inside the station.

It may appear that the cost of a repeatered telephone circuit, taking into account everything that has been described above, would be very high, but the fact is that a modern underground cable circuit with its associated repeaters costs considerably less, both in capital and annual charges, than an equivalent overhead road line circuit, and this comparison is made without taking into account the loss of working time that is unavoidable on aerial lines.

The B.E.A.M.A. and the Birmingham Discussion.

WE have received the following communication from Mr. D. N. Dunlop, Director of the British Electrical and Allied Manufacturers' Association, bearing upon the discussion at a meeting of the Birmingham City Council, which was reported in the ELECTRICAL REVIEW for June 13th, p. 985:—

Alleged Profiteering by Electrical "Ring."

In view of the general interest which appears to have been aroused by the discussion at the meeting of the Birmingham City Council on June 3rd, I send you herewith a copy of my letter to the Town Clerk of Birmingham, for publication in your columns.

Yours faithfully,
D. N. DUNLOP,
Director, British Electrical and Allied Manufacturers' Association.

London, W.C.2.
June 16th, 1924.

To the Town Clerk, Corporation of Birmingham.

Sir,

ALLEGED PROFITEERING BY ELECTRICAL "RING."

In the Birmingham newspapers of the 4th inst. reports were given under some variant of the above title, of the proceedings of your City Council meeting held on the 3rd inst., wherein Mr. Beale, the Chairman of the Electric Supply Committee, in presenting a report as to the prices tendered to a certain contract, is stated to have made certain observations gravely reflecting on this Association.

According to the reports, Mr. Beale's statement was to this effect:—

Four contracting firms were invited to tender for some new plant to meet the requirements of a specification submitted to them by the Corporation. The tenders received ranged from £9,000 to £9,765. A certain firm "Were making almost identical plant for them at the time. There were some slight differences in detail, but substantially it was the same plant." This firm accidentally got to know of this inquiry and asked to be allowed to submit a tender in accordance with the specification. Their price was £9,360; they were, however, willing to carry out the work as an extra on their existing contract for the price of £3,615.

Upon these "facts" the reports make Mr. Beale comment as follows:—

> Nearly all these big manufacturers were members of an Association—the British Electrical and Allied Manufacturers' Association . . . it was obvious that the four firms were either in a ring by themselves or were being controlled by the Association.

Mr. Beale then founded on this a homily on the iniquity of profiteering in general, and proceeded to say that it was not the contracting firms he blamed, but the Association; it was difficult to see how it could hold together where there was such a "bare-faced attempt at fleecing the public."

To clear the ground I must first point out that neither the governing body of this Association nor any member of the staff had any knowledge of the invitation to tender issued by the Corporation, nor of the fact that members of the Association were tendering. On inquiry I found that the firms referred to were members of this Association, and in the interest of the Association and owing to the publicity given to the matter I invited them to place before me full particulars of the tenders made to the specification issued by the Corporation. I have also had the specification submitted to me.

This investigation, including information from the company which has been successful in securing the order, has revealed that the switchgear called for by the specification was for oil switches and connections to be installed in stone cell-work, each phase to be installed in a separate cell and the details were such that a considerable amount of development work and of expenditure on special tools and jigs would have been required; in particular the bus-bars and all connections of the switchboards were to be covered with insulating material throughout (including the joints) in such a way that they would withstand a test between the exterior and interior of the insulation of 100,000 volts for five minutes, the working voltage of the board being 33,000. In some particulars, the switchboards were such as have never been manufactured up to the present and would involve the development of special methods of construction and insulation; even after extended experiment, the contract would have involved the manufacturer in considerable financial risk owing to the fact that there existed no previous experience with identical gear. All these considerations naturally prevented the manufacturers from quoting a low price.

The switchgear actually being supplied by the firm already engaged on the first contract is entirely different from that required by the specification, *i.e.*, it is of their standard metal-clad type (not cell type), with direct hand-operated oil switches and without remote electrically-operated control.

The difference in cost of the two designs, one standard and the other experimental, justifies the difference in the prices around which the discussion centred in the City Council meeting.

These are the plain facts of the case, and I have to ask you to acquaint your Council of them and to have equal publicity given to the subject as on the former occasion. In view of the serious charges made against the members of this Association, I think you will desire to rectify the false impression created by the statements made at the meeting.

On the general charge of profiteering in the electrical industry: A glance at the balance-sheets of the electrical machinery manufacturing concerns in this country will reveal the fact that there is no foundation for the allegation.

Owing to the publicity given to the statements made at the meeting of the Council, I am sending a copy of this letter to the Press.

Faithfully yours,
D. N. DUNLOP,
Director, British Electrical and Allied Manufacturers' Association.

London, W.C.2.
June 14th, 1924.

Councillor Beale's Reply.

The *Birmingham Post* of June 19th reproduced Mr. Dunlop's letter, together with the following statement made to one of its reporters by Councillor Beale:—

"There is very little in the observations of the director of the Association which calls for a reply. The fact remains that five firms, all members of the Association, quoted £9,000 or over for the plant in question, and that one of them is willing to make the plant required for £3,615, and to execute as many more orders for similar plant as we like to place with them at the same rate. The Association dispute that the plant asked for is similar to that now being made by the firm in question or to which they will make for £3,615. It is almost exactly the same, the only difference between their type and the plant certified being that one is enclosed in iron and the other in stone, the cost being approximately the same in both cases. The gear now being constructed is enclosed in iron, and certain parts which are now boxed in and inaccessible are to be made accessible at a total extra cost of £255, which is allowed for in the sum of £3,615. If it had not been for this small difference in design, the contract price at the rates already accepted for the earlier contract would have been £9,360. Whether the switch gear is accurately described as substantially similar, is a matter of opinion. What is undisputed is that one of the firms is willing to carry out the work for £3,615, for which they themselves and the other four firms all quote £9,000 and over. Mr. Dunlop states that neither the governing body of the Association nor any member of the staff knew that their members were tendering. I must, of course, accept his statement, but whether the members of the Association did or did not combine to raise prices against the purchasers, or how it was that all five quoted between £9,000 and £9,765, are questions upon which I must leave the public to form their own opinion."

Parliamentary Questions.

OUR Parliamentary reporter states that the subject of the Birmingham tenders was raised in the questions in the House of Commons on June 27th.

Mr. PERRY asked the President of the Board of Trade if his attention had been called to the prices quoted in tenders recently received by the Birmingham City Council for the supply of electrical machinery; whether he was aware that four firms, members of the British Electrical and Allied Manufacturers' Association, submitted tenders, the lowest being £9,000 and the highest £9,765, and that the Birmingham City Council then invited another firm, already under contract, to tender, whose estimate of £3,615 was accepted; and, in view of such attempts to profiteer at the expense of the ratepayers, would he introduce legislation to restrict the operations of rings and trusts in this country?

Mr. WEBB said he had no knowledge of this particular contract, but he should be glad to consider any further information which could be furnished. As regarded the last part of the question, in view of the position of Parliamentary business, it would not be possible to introduce legislation on this subject, other than the Building Materials (Charges and Supplies) Bill, during the present session.

According to the *Financial Times*, Major BARNETT then asked whether it was not obvious that there was some misdescription in the form of the tender which the firm already under contract understood and the other firms did not.

Mr. WEBB said he had no knowledge on that subject, and he could not be sure that that was the fact.

Mr. PERRY: Will the right hon. gentleman ascertain from the Birmingham City Council what they think about it?

Mr. HARDIE: Is it not a fact that when a Council sends out specifications, these are in printed form, so that there could be no mistake?

Questions at Wolverhampton.

The Birmingham controversy is giving rise to questioning in other parts of the country. For example, under the title "Wolverhampton and an Electrical Combine," the Birmingham *Daily Post* of June 17th contains the following:—

"An echo of statements made recently in Birmingham was heard at Wolverhampton Town Council yesterday, when Mr. Beach asked the chairman of the Electricity Committee whether that body had any difficulty in getting materials supplied through 'the electrical combine at present working.'

"Mr. Jas. Thompson replied that he had no knowledge of any difficulty of the kind suggested. He would, however, inquire whether any other Councils were finding difficulty, and if there were any difficulties he would inform the Council. He thanked the questioner for the warning he had given on the subject."

Just what Mr. Beach's warning was is not recorded in the *Post*, but in the *Gazette Express* he is reported to have "added that only on Saturday a Birmingham Councillor informed him that on one of their contracts the lowest tender was £9,000 odd, but one of the contractors sent a covering letter saying that to save himself he had to make it according to the combine, but if they would give him the job he would do it for some £3,000."

A Kinema Lighting Installation.

THE Regent Theatre, Norwich, which has recently been opened, is one of the most comfortable kinemas in the Provinces. Designed for a seating capacity of 1,000 persons, and primarily intended for a kinematograph theatre, it is, however, provided with a stage sufficiently large to accommodate dramatic touring companies.

By the courtesy of Mr. George T. Regment, the consulting engineer, we are able to give some particulars of the electric lighting arrangements carried out to his instructions, and to reproduce the accompanying illustration of the theatre.

The lighting scheme throughout has been designed to produce a soft diffused lighting effect with no risk of eye-strain. Special fittings have been designed and manufactured by the

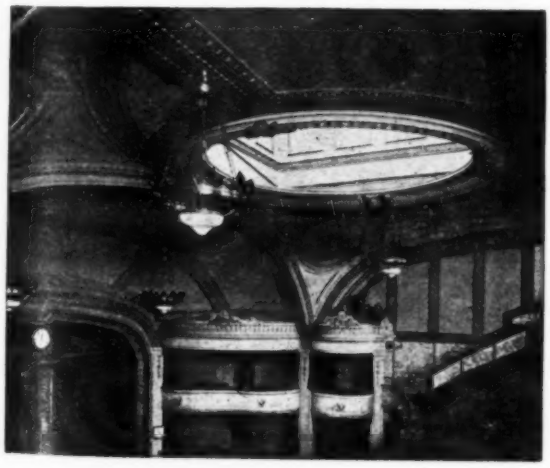


Fig. 1.—The Lighting of the Regent Theatre, Norwich.

General Electric Co., Ltd., to achieve this end. The fittings on the main ceiling over the auditorium are designed to harmonise with the decorations. They consist of a substantial ceiling-plate with six stout metal straps supporting a decorative corona band, 4 ft. in diameter, with six pairs of flambeau brackets carrying ruby-coloured shades. Metal straps springing from the brackets on the main band support a smaller decorated band below carrying a 24-in. "Superlux" bowl. Each flambeau shade contains a 60-W "Osram" vacuum lamp, while the main illumination is obtained through the medium of a 1,000-W "Osram" gasfilled lamp in the "Superlux" bowl. Seven of these units are fitted over the auditorium. A feature of the flambeau shades is that they contain colour-sprayed "Osram" lamps, and, when illuminated, produce the realistic effects of the old-time lighting unit. The "flames" appear to vary in height, colour and intensity according to the angle from which the units are viewed.

During the showing of the pictures these units are illuminated, thus meeting the requirements of the authorities by providing sufficient light for entry and exit, while in no way affecting the picture being shown.

On the balcony and box fronts eleven 2-light crossed flambeaux on gilt colour brackets with satin shades are fitted, while on the back and side walls fourteen 2-light brackets of similar design are fixed.

The first floor promenade is illuminated by three gilt colour ceiling fittings with 12-in. "Equiluxo" hemispheres, each containing a 100-W gasfilled lamp.

The large gasfilled lamps in the units over the auditorium are arranged on separate circuits through dimmers worked from the operating room. These enable any desired degree of lighting to be obtained. A system of master control is also arranged so that, in case of emergency, the auditorium can be instantly flooded with light.

The whole of the electrical work at this theatre has been carried out by Messrs. Mann, Egerton & Co., Ltd., of Norwich.

Legal.

Fraudulent Use of Electricity.

AT the Bristol Police Court on June 16th, Herbert Charles Thrush was prosecuted by the Bristol Corporation for the fraudulent consumption of electricity. It was stated that the defendant was an electrical engineer and a consumer of electricity for lighting only. One of the Corporation's engineers found that a meter on defendant's premises was not registering current, as the fuses had been tampered with. Moreover, defendant was using electricity for power purposes. There was evidence that this had been going on for some time. Defendant said that a gas engine which he used had broken down on the morning of the inspection, and he had made temporary connections to a motor-generator set for charging accumulators. He also stated that the fuses blew when the set was switched on, and he had made an error in connecting up afterwards. A fine of £5 and two guineas costs was imposed.

British Thomson-Houston Litigation.

IN the Chancery Division, before Mr. Justice Eve, on June 19th, Mr. Trevor Watson, on behalf of the British Thomson-Houston Co., Ltd., made an application that a number of actions in which that company was plaintiff and which stood in his Lordship's list waiting trial should be directed to stand over until the appeal to the House of Lords in the case of the British Thomson-Houston Co. against the British Insulated and Helsby Cables, Ltd., was decided. Counsel stated that all undertakings or injunctions which had been given or granted would be discharged.

Mr. Clayton, K.C., and Mr. Courtney Terrell, or Mr. Terrell alone, appeared for the following defendants, and consented to the course proposed: Vennootschap Philips Gloeilampenfabrieken; the Irradiant Lamp Works, Ltd., and others; the Northern Steel & Hardware Co., Ltd.; the Armature Repair Co.; Auto Bulbs, Ltd., and others; Smith & Cookson; the Weston Electric Lamp Co.; Childs; the Midget Lamp Co., Ltd.; and the Calphos Electrical Co., Ltd.

His LORDSHIP acceded to the application.

Paragon Electric Welding Co., Ltd.

MR. JUSTICE TOMLIN, in the Chancery Division on June 17th, sanctioned a petition of this company, of Cardiff, for the reduction of its capital by writing 15s. per share off its 6,326 issued and paid up £1 shares, and sub-dividing the unissued capital into 5s. per share.

Mr. HODGE, for the company, said this would wipe out the amount of capital lost or unrepresented by available assets, *viz.*, £4,744. He read an affidavit by the company's chairman that the loss was attributable to acute depression in the ship-repairing trade and heavy depreciation in the value of plant and machinery bought during the boom in 1919.

Theft of Copper.

AT Burnley, on June 20th, John Eastwood, Bert Eastwood, and George Ridge, all carters, pleaded guilty to stealing 294 lb. of scrap copper wire, value £7 10s. 11d., the property of W. T. Henley's Telegraph Works Co., Ltd. George Pickup, broker, Fairview Road, pleaded not guilty to stealing the wire.

The first three prisoners were placed on probation and ordered to pay costs. Pickup was fined £5 and costs. Inspector M'Kniff asked for Pickup's licence to be revoked, but the Bench replied that the punishment was sufficiently severe, and they would neither revoke nor suspend his licence.

Claim Against Edinburgh Corporation.

A SETTLEMENT was intimated in the Court of Session, Edinburgh, on June 20th, in an action by Mrs. Elizabeth W. Macpherson against the Corporation of Edinburgh for payment of £250 as damages for personal injuries. On the afternoon of January 4th last the pursuer proceeded to board

one of the defenders' electric tramway cars at a stopping place in Nicolson Street. She took hold of the brass canopy rod at the outside of the platform of the car, when she received a severe electric shock. As a consequence she was confined to bed for three months, and still suffered from sleeplessness and extreme nervousness.

The defenders denied that the accident was due to fault or negligence on their part. They explained that the insulation of railings or canopy rods was not required by the regulations of the Ministry of Transport, and would be objectionable on mechanical grounds. Just as the pursuer grasped the canopy rod an open circuit was caused, apparently owing to the fact that all four wheels simultaneously came to rest upon portions of the rails which were coated with sand, thus preventing proper contact between the car and the earth. They further stated that the voltage causing the shock in the circumstances described was not sufficient to be in any way dangerous or to cause more than temporary discomfort.

The action was settled by a payment to the pursuer of £100 and expenses.

Parliamentary.

[By Our Special Parliamentary Reporter.]

Wireless Telephony.—On June 17th, Sir H. BRITTAIN asked the Postmaster-General whether he could inform the House of the progress recently made in wireless telephony.

Mr. HARTSHORN said that experiments were in progress to test the possibility of establishing a commercial telephone service between England and the United States of America. Spasmodic communication had been achieved over extremely long distances, but the aim of the experiments which were now being conducted was to devise a system which would give a reliable and continuous service.

Relief of Unemployment.—On June 18th, Mr. D. G. SOMERVILLE asked the Minister of Labour whether he could state the proposals now being considered by the Government for the relief of unemployment which might be regarded as specially applicable beneficially to the case of the unemployed in the engineering industry.

Mr. SHAW said a number of schemes assisted under the Trade Facilities Act or by the Unemployment Grants Committee involved the production of material which would provide work in the engineering trade. Other schemes, particularly in connection with electrical development, were under examination.

Wireless Bulletins.—On June 19th, Mr. E. BROWN asked the Postmaster-General whether there was any censorship of news transmitted from wireless stations in England.

Mr. HARTSHORN said that the answer was in the negative. A bulletin of news was prepared by the Foreign Office and transmitted daily by wireless telegraphy from the Post Office station at Oxford at noon, 8 p.m., and midnight, Greenwich mean time. No restrictions were placed on the use of Government messages. Other messages might be covered by copyright.

Sale of Wireless Stations.—On June 19th, Mr. BAKER asked the Postmaster-General when informal conversations for the sale of the Stonehaven wireless station to the Danish Great Northern Telegraph Company first took place, and when the Donald Wireless Report was first considered by the Cabinet.

Mr. HARTSHORN said that the answer to the first part of the question was March 20th, and, to the second, towards the end of February.

Electrical Development.—During the debate on the Board of Trade Vote on June 19th, Mr. LLOYD GEORGE urged the greater development of electrical energy. Taking electrical energy in kilowatt hours, he said that Great Britain had 2,500,000,000 kWh in 1913, and that had gone up to 5,739,000,000, an increase of 130 per cent.; France had increased from 750,000,000 to 2,700,000,000, an increase of 247 per cent.; Germany had increased from 2,238,000,000, which was below ours in 1913, to 7,234,000,000, an increase of 223 per cent.; and the United States from 13,140,000,000 to 47,717,000,000.

Mr. WEBB, the President of the Board of Trade, said, in reply, that the Government was doing its utmost to stimulate electrical development.

The Demand for Trained Engineers.—Professor Marchant, of the Electrical Engineering Department of the Liverpool University, declared recently that applications for men were being received in excess of the number of students leaving. He believed that this demand for highly-trained electrical engineers would keep on increasing. During the past four years, 100 men had gone to good positions. He referred to the approaching transformation of the telephone system, the electrification of railways, and development in the use and distribution of electricity as being likely to call for greater numbers of thoroughly trained men.

Reviews.

Junior Magnetism and Electricity. By R. H. JUDE, M.A., D.Sc., and J. SATTERLY, M.A., D.Sc. Second Edition. Pp. viii+288; figs. 171. London: University Tutorial Press, Ltd. Price 4s. net.

This book has been prepared by Dr. Satterly, but is based on the well-known text-books "School Magnetism and Electricity" and "First Stage Magnetism and Electricity," by Dr. R. H. Jude. In general method of treatment the new book follows the lines of the old ones, and this second edition differs from the first only in so far as it has been brought more fully into accordance with the requirements of the Junior Local Examinations of the Universities of Oxford and Cambridge.

The fettering influence of this deliberate writing up to (or down to) an examination syllabus is evident in many parts of the book. It appears to be more important for the junior student to know all about the Grove cell (with platinum at any price per lb.) than to be given information concerning electric lamps of later date than the nineties of last century. It seems a pity, too, that when practically every boy is familiar with the appearance and construction of both fixed and variable condensers as used in radio apparatus, the treatment of condensers in a book such as this should be confined to the Franklin pane and the Leyden jar.

In fact our whole criticism of the book is that it is not sufficiently in touch with the useful practical facts of electricity; it is too much concerned with "preliminary considerations and nomenclature" and with paragraphs which needlessly labour the idea of potential and, in general, the treatment is so academical that boys using it would justly dub it "dry."

The author in his preface refers to the illustrations as forming a "special feature of the book," but here again he fails to impress us; practically every figure in the book may be described as quite commonplace. Altogether we feel that a junior magnetism and electricity ought to be more imaginative, more inspiring, and more practical in its outlook than this rendering, and these ideals should not be sacrificed to "meet the requirements" of any examination syllabus.

P. H. S. K.

Compressor Theory and Practice.—By J. M. FORD. Pp. xx+345. Figs. 150. London: Constable & Co., Ltd. Price 31s. 6d. net.

A considerable number of books have been written about the air-compressor, but very few have dealt with the multi-stage compressor in an adequate manner. Special attention, however, has been given in this work to the multi-stage type.

The construction and working of single-stage compressors has followed fairly well-known and well-defined lines, and the author considers that no useful purpose would be served by including this type among the actual examples given.

First principles of thermo-dynamics, and the various laws relating to heat energy are fully discussed in Chapter I, and this subject is covered in a very practical manner, examples having direct application to the science being given.

It is strongly urged by the author, and most engineers will agree, that the temperature-entropy diagram should be used in compressor calculations, and extensive references are made to this throughout the book.

The specific heat of gases, the numerical value of specific heat, and the molecular heat of gases are dealt with in an exceedingly able and satisfactory manner.

In Chapter III gas mixtures are considered, and it is rightly pointed out that gases which have to be used in modern engineering and technical processes are really mixtures of gases, air for example being mainly oxygen and nitrogen; it is therefore necessary in order to construct compressor plants, to know something about the thermodynamic properties of gases.

A simple definition of entropy is stated, and this important matter is very fully dealt with, tables of pound-molecule entropy changes for given temperatures and pressures being given.

Considerable space is devoted to the changes of state in gases, and a large amount of original information, together with worked out problems, are given.

Chapter VII of Section B of the book deals with the functioning of compressors, and indicates one cycle of operations in an ideally constructed compressor with isothermal, adiabatic, and polytropic compression.

The difference between ideal and actual compressor conditions owing to constructional difficulties, and the limitations imposed by the properties of the materials used are pointed out, and the designer of air compressors will find this section particularly useful.

The theory of multi-stage compression, intercooling, and the mechanical aspect of stage compression, take up some thirty pages of the work, every word of which is of interest to the expert.

Purchasers of air-compressors are, of course, mainly concerned with the mechanical design, the general construction and reliability, and with the cost per unit of the air or gases

delivered by the machine. The chief object of the test is to find the actual output of the machine, and the consumption of power; both these important questions are thoroughly gone into in a practical manner, and leave little to be desired.

Section C of the book gives the lines on which modern compressor construction is proceeding, and numerous examples of recent designs are fully illustrated and described. Constructional details of modern multi-stage machines occupy a very considerable space.

The author sets out with the object of presenting an outline of compressor theory and construction from the point of view of the designer, and he is to be highly complimented on the extremely able manner in which he has succeeded.

A great deal of the information given is thoroughly practical, it is all right up-to-date, and the designer of air-compressors will welcome the book as an authoritative and reliable treatise on an important branch of engineering work.

E. P.

Rotary and Other Converters. By W. S. IBBETSON, B.Sc., A.M.I.E.E. Pp. viii+163; figs. 49. London: E. & F. N. Spon, Ltd. Price 7s. 6d. net.

The production of a practical handbook on sub-station machinery is overdue, for there are few published books dealing exclusively with converting plant. Modern tendency in electrical power generation and its distribution for traction purposes is towards the erection of increasingly large power stations and the linking-up of existing high-voltage networks. Sub-station plant and its control will exercise in the future a still greater influence in the economical supply of power over large areas. The fundamental principles underlying the performance and handling of converting plant are not capable of explanation in such a simple manner as the parallel running of dynamos or of alternators. In spite of this, there is no doubt that the author has been entirely successful in writing a book that will make an appeal not only to sub-station attendants, to whom the treatise is specially directed, but to all electrical engineers interested in converting machinery and sub-station practice. In pleasant contrast to many so-called practical handbooks, the theoretical aspect of the subject is treated in a most satisfactory manner. The reader with only a limited mathematical knowledge is here not patronisingly pandered to, but is given a concise and comprehensive insight into the physical explanation of the behaviour of the apparatus under consideration. In the opening chapters an elementary account of alternators, dynamos and motors is submitted, together with a short account of the alternating-current circuit, including power and power factor. The relative advantages of synchronous and induction motor generators, rotary converter, motor converter, and mercury arc rectifier are stated. There is only this short reference to the mercury arc converter, the subject of which might be well extended in a succeeding edition. The theory of the rotary converter is explained in a simple but thoroughly satisfactory manner, and included in this survey are the subjects of power factor and heating, voltage regulation, the function of interpoles, flashing, hunting and surging, and the use of inverted rotaries. The succeeding sections deal with the operation of rotaries and motor converters, and here the information given is reliable, practical, and thoroughly up-to-date, particularly with regard to the several methods of starting and synchronising. The latest practice with regard to self-synchronising machines and their transformer connections is explained and illustrated by a number of well-drawn connection diagrams. All diagrams throughout the text are accurate and admirably clear, and the book may be unhesitatingly recommended to all who are in any way interested or connected with the subject.

Alternating-current Armature Winding. By TERRELL CROFT. Pp. vi+352; figs. 326. London: McGraw-Hill Publishing Co. Price 15s. net.

Here is another of the many books on practical electricity by Terrell Croft. It is intended for those engaged in the design, construction, or repair of alternating-current windings. The work is done very thoroughly, and though readers in this country may find some of the American terms rather strange, the definitions and diagrams should remove difficulties. After classifying and defining the manifold types of windings for alternators, and induction and repulsion motors, practical instructions are given for re-winding machines and for re-connecting existing windings for different conditions. At the end of each chapter questions and problems are added, the solutions to numerical exercises being given near the index. A special chapter is devoted to unusual connections, where two-speed windings, &c., are dealt with. Testing stator windings for faults is a fitting conclusion to the above. The last chapter in the book contains standard diagrams for stator windings. No fewer than 165 diagrams of single-, two-, and three-phase windings are given, while each figure consists of a theoretical and a winding diagram. So long as motors were returned to manufacturers for repairs, the demand for such information was limited; at the present day, great numbers, who have had no training as designers, have to undertake such work. It is the latter who will be mainly thankful to the author for the immense amount of labour taken in the preparation of this book.

The Influence of Industrial Research on Progress in Physics.

(*Abstract of Presidential Address by* SIR CHARLES A. PARSONS, F.R.S., *to the* INSTITUTE OF PHYSICS.)

WE have heard much lately about the importance of physics to industry, and from time to time lectures are being given under the auspices of the Institute of Physics illustrating that theme from examples taken from the different branches of manufacture. In his Presidential Address recently delivered to that Institute, Sir Charles Parsons dealt mainly with the converse influence which industry has exerted upon science, and he adduced many examples where the requirements of the engineer or the results of engineering progress have a strong incentive and a practical stimulus towards fundamental physical research. A striking example is the case of James Watt, who was led by engineering to study the properties of steam and who thus acquired much more knowledge of this subject than the professed chemists and physicists of his day. The work of Watt influenced physicists to direct their attention to the determination of the properties and laws of steam, and on the knowledge obtained were based the laws of thermodynamics. Nowadays Watt would be called an engineer-physicist. Even the great work of Joule on the dynamical equivalent of heat and the absolute zero of temperature arose from an attempt by him to improve an electromagnetic engine worked by the electrolytic consumption of zinc, which he thought would supersede the steam engine as a prime mover. The case of Sadi Carnot is too well known to need reiteration. The fact emerges that the foundations of the science of thermodynamics were laid by engineers in attempts to solve engineering problems.

A notable example of another type of engineer-physicist was Lord Armstrong, famous as the introducer and manufacturer of hydraulic machinery and big guns. Although not a mathematician, Armstrong was essentially a physicist in his methods of thought and investigation, and it was because he had a better faculty for dealing with and applying the fundamental laws of physics that he was more successful than Whitworth. On one occasion he observed, by chance, that a tie-bar in the roof of his boiler-house emitted electric sparks. He found that a leak of steam from an adjacent pipe was playing upon the rod and that, the roof being of wood, the tie-bar became electrically charged. He then carried out experiments and found that the best results were given by jets made of ivory of such a shape as to cause a maximum amount of friction to the issuing steam. He thus invented his hydro-electrical machine for generating high-pressure electricity from saturated steam.

Some interesting details were given relating to the invention and development of the Parsons steam turbine, as illustrating the position of physics in invention. Some preliminary experiments were made with high-speed shafts and bearings, but in order to complete the necessary data a small turbine coupled to a high-speed dynamo of primitive design was made. The calculated stresses due to centrifugal force, the laws governing the flow of steam and data from dynamos, as approximately known at that time, were taken into account. The constants for the flow of steam, the loss by friction in bearings at high surface speeds, the hysteresis and eddy current losses in armature core, conductors, and binding wire at abnormally high speeds were approximately investigated. Higher mathematics were not employed in this work but were used later to co-ordinate the accumulated data and forecast the effect of small improvements which have, in recent years, considerably increased the thermal efficiency of the turbine. It is interesting to note that the two men who directed the work had passed University courses in physics and mathematics, as well as being trained engineers. This example emphasises the fact that in pioneering engineering work higher mathematics is valuable in consolidating the rear and assisting the communications rather than in leading in the advance. On the other hand, the coming of the steam turbine has had the effect of stimulating research in certain directions, such as the dynamics of rotating shafts, the law of flow of saturated and superheated steam through jets, and the frictional resistances to flow through passages and over surfaces.

In conclusion, Sir Charles drew attention to the position of the scientific instrument industry in this country. While the present slump is largely the result of post-war conditions and economic policy, he thought that there was, perhaps, a too exclusive individualism, involving overlapping and lack of interchange of knowledge between the various manufacturers, more pronounced than in some other industries. He concluded with a strong appeal to users of scientific instruments to help the British manufacturer by buying here instead of abroad, so as to enable him to provide himself with better equipment and a more skilled staff.

E

Correspondence.

Correspondents should forward their communications **at the earliest possible moment.** *No letter can be published unless we have the writer's name and address in our possession.*

A Mathematical Query.

"A. H. M.'s" difficulty is due to the definition of "Permeance" adopted by S. P. Thompson. One method of arriving at the formula is given below, the various quantities involved being in absolute units.

Energy in coil = $\frac{1}{2}Li^2 = Li.i/2$ .....(1)

If L is defined as the number of interlinkages or line turns due to unit current, Li represents the total interlinkages due to a current i. Thus expression (1) may be rewritten :—

Energy = $Nni.i/2$.....(2), where Nn = total interlinkages.

When the core is moved through a distance dx, the flux changes by an amount dN. The useful work done is :—

$Fdx = dN.ni/2$.....(3), where F = pull on core in dynes.

Therefore $F = ni/2.dN/dx$.....**(4).**

Assuming the well-known formula $H = 4\pi ni/l$, where l is the length of the solenoid, to apply in the present instance, we get $N = BA = \mu e HA$.....(5), where μe is the *effective* permeability of the complete magnetic circuit.

In general the flux distribution throughout the solenoid will not be uniform. Where there are many layers, the value of H varies from the inner to the outer layer, and if the ratio length : mean diameter is small, the flux is far from uniform at the ends, especially with an air core. Although an iron core causes a more uniform flux distribution, it must be understood that H is taken at the centre of the solenoid, A is the cross-sectional area of the iron, and μe is an effective value of permeability of the complete circuit in which allowance is made for non-uniform flux distribution, the flux in the winding between the inner and outer layers and the demagnetising effect or loss of flux due to the iron core not being closed. Expressed in another way, it is necessary to allow for the flux not being interlinked with all the turns on the solenoid. μe may be defined as the ratio

$$\frac{\text{Interlinkages with iron}}{\text{interlinkages without iron}},$$

the current being the same in both cases. If μ the permeability of the iron *per se* is used, a correction factor is required to cope with the above effects.

Expression (5) may be written $N = 4\pi\mu eA/l.ni = P.ni$.....(6) where—following Thompson—P may be designated the *permeance*.

Differentiating (6) we obtain $dN = ni\ dP$, and substituting this value for dN in (4), we have $F = (ni)^2/2.dP/dx$ dynes...(7).

Converting i to amperes, $F = (ni)^2/200.dP/dx$ dynes.....(8), as given by Thompson.

Personally, I do not favour the term "permeance," because engineers are more familiar with the expression "reluctance." In a complex circuit the latter can be defined as $l/A\mu e$. If permeance is the reciprocal of reluctance, it should be regarded as $A\mu e/l$, and not as 4π times this quantity. Defining permeance thus, (8) becomes $4\pi(ni)^2/200.dP/dx$. When (8) is expressed in terms of reluctance R, it becomes $F = 4\pi/200.(ni/R)^2.(-dR/dx)$. The negative sign indicates that R decreases as the core is pushed into the solenoid, *i.e.*, as x increases. Thus $(-dR/dx)$ is positive.

N. W. McLachlan.

Chelmsford, *June 21st*, 1924.

Pulverised Coal Firing.

Mr. W. D. Wylde's doubts expressed in his letter on page 946 of your issue of June 6th, as to what he calls "the ash-vanishing trick," can easily be solved if he will honour us with a visit to inspect the Atritor pulverised-coal-fired boiler at our Edgwick works.

This installation has been at work for about two years and, although the top of the stack shows an incrustation of white ash, there is no trace of ash deposit to be found anywhere on the very large area of shop roofing in the immediate neighbourhood. There is, in fact, no ash to be found, although plenty of ordinary dust is deposited after every gust of wind.

We should be glad to offer Mr. Wylde every assistance in his investigations.

Alfred Herbert, Ltd.
P. V. VERNON, *Director.*

Coventry, *June 17th*, 1924.

Protection Against Pressure Rises.

We are naturally much interested in your editorial article published in last week's ELECTRICAL REVIEW, as well as the description of protective apparatus against phenomena of pressure rises, only, we do not understand in what way this system differs from similar appliances which, like our Giles valves, have been on the market and very extensively installed for the last fifteen years.

The writer of the article, himself, it is true, does not claim "anything particularly new," but whether or not anyone is free to make use of it, is altogether another question, seeing that we hold certain patents in connection with such apparatus.

The subject of pressure rises, whether of internal or external origin, is, of course, one with which we have occupied ourselves for many years, and we are always glad to hear of any progress made in this particular field of engineering, but really, from your description we cannot see where any basic difference comes in, since what we and other makers for years past have been installing, can likewise be summed up as follows: a number of spark gaps between some metal cylinders or disks, connected in series with current-limiting resistances or resistance of the non-inductive carbon type, connected to the high pressure end of the feeders through an isolating switch and protective fuse. The last gap serving as an indicator by perforating a paper strip, is a feature which we do not include in our valve, but which has been common practice in the United States for some time past. Where our valve, however, does differ from and greatly improves upon, the protection described in your article, is that in order to deal with sufficient energy, and it being impossible to reduce the limiting resistance beyond safe limits, the Giles valve consists of a number of similar discharge paths (gaps, limiting resistances, and fuses) which, by the discriminating action of the surge itself, are automatically paralleled in order to eventually reduce the total resistance sufficiently to relieve the feeder from a surge of any magnitude.

Isenthal & Co., Ltd.,
A. W. ISENTHAL, *Director.*

London, *June 23rd*, 1924.

[Messrs. Isenthal's work in connection with this subject is well known and appreciated. The important feature of Mr. Partridge's article is the fact that it is a record of actual experience extending over a long period, on a large system of trunk mains, with extremely satisfactory results. Hence the information ought to be very useful to engineers in charge of such systems, and, incidentally, should prove advantageous to our correspondents as testifying to the efficiency of this method of protection.—EDS. ELEC. REV.]

Poland's Progress towards Recovery.

POLAND, helped by the advice of Mr. Hilton Young and his Financial Mission, has recently made marked progress towards financial and economic stability. The movement has been materially assisted by the introduction of legislation for placing State revenue on a gold basis and thus making it independent of exchange fluctuations, by increasing the direct and indirect taxes, by raising the railway and telegraph rates, by collecting energetically the property tax, and generally by introducing economies in administration. During the difficult process of readjustment, troubles are, of course, expected, but it is felt that great and undoubted benefits will ultimately result.

Mr. R. E. Kimens, the Commercial Secretary at Warsaw, refers to the foregoing points in his recent report on Poland, and remarks on the satisfactory level at which production was maintained last year. The number of unemployed was not increased, the yield of the crops was largely in excess of that of 1922, whilst the trade balance remained favourable, although at the turn of the year there was a period of depression. Mr. Kimens feels that the very considerable natural and industrial riches of Poland, which are one of the indispensable conditions for the prosperity of a country, form a sufficient guarantee that with political stability, the adoption of a sound financial policy, and the improvement of the administration, Poland should be in a position to overcome the one real evil from which she is suffering—the deficit of the Budget—and to become an important economic factor in Europe.

British electrical firms are taking a considerable interest in the Polish market, assisted by credits granted under the Trade Facilities Act. As a result, it is hoped that British power plant will be seen to an increasing extent in the Warsaw area. The demand for current for lighting, power, and traction purposes is growing.

The Commercial Secretary mentions that the value of imports from Great Britain into Poland has been maintained at a monthly average of over a quarter of a million sterling, due partly to the decreasing effectiveness of German competition, exporters from that country having been obliged to sell their goods only in dollars, sterling, or Swiss francs. It is true that the volume of British trade is insignificant in comparison with that of German trade, and further, in Mr. Kimens's opinion, it will never be possible for Great Britain to approach Germany in the Polish market. Yet last year's records have shown that Poland is not a negligible market for the sale of British goods. Consequently, imports should increase substantially with a stabilised exchange, the advent of more favourable conditions in general and the adoption by British merchants of certain indispensable business methods.

Trading Methods.

In the Commercial Secretary's opinion the first condition is to bring down British prices to the level of others. The second consideration, which is equally important, is the question of methods and payment. He draws attention to

the fact that in Poland, the pre-war methods of doing business on a credit basis are now dormant only in consequence of the present financial conditions, but that after the return to a stabilised currency, the supply of money at easier rates, and, above all, after the re-establishment of confidence in Poland, a revival of the old methods is inevitable, and, given an improvement in the financial situation in Germany, the credit system will, in the first place, be adopted by that country.

The recommendation to sell goods in Poland on a credit basis is advocated, but with certain reservations and the usual caution; even now business can be done on such a basis without special risk; the employment of the right persons as agents will safeguard British interests from losses and, although it may sound paradoxical, the sale of goods direct on a cash basis to unknown buyers presents often more risk than sales on credit through the intermediary of good and reliable agents. Sufficient stress cannot be laid on this point; on it depends to a large extent the capture of the Polish market.

For negotiations with Government departments, it is desirable that British firms should be represented by Polish, and not English, houses of good standing and possessing the necessary connections in Government circles. In order to overcome the disadvantages resulting from the less favourable geographical situation of Great Britain than of Germany, Austria, and Czecho-Slovakia, owing to which deliveries cannot be effected promptly, it is essential to have consignment stocks of British goods: a further advantage of these stocks is the possibility of avoiding losses in the exchange which cannot as yet be discounted, as goods can be sold at the equivalent in Polish marks ruling on the day of the sale and converted on the same day into sterling. It is further essential for British merchants:—

(*a*) to adapt themselves to the local requirements and the taste of the people;
(*b*) to quote f.o.b. Danzig;
(*c*) to accompany offers and tenders by catalogues and drawings, giving, if possible, the measures and weights in the metric system;
(*d*) to send out periodically English representatives for the purpose of inspection of local agencies, and for the visiting of clients;
(*e*) to correspond either in Polish, French, or German;
(*f*) to employ as agents only Poles or Englishmen;
(*g*) to abandon the pre-war practice of appointing German houses for the representation of British firms in Poland.

Business Notes.

The "Electrical Review" Index.—The Index for the last half-yearly volume of the ELECTRICAL REVIEW (January to June, 1924) is now being printed. Copies will be forwarded post free to those requiring them for binding or for reference purposes, if they will make application at once to the Publisher, ELECTRICAL REVIEW, 4, Ludgate Hill, London, E.C.4.

Bankruptcy Proceedings.—CHARLES TURNER, Yard 57, Highgate, Kendal, Westmorland, consulting motor engineer.—The receiving order in this matter was made recently on debtor's own petition. The first meeting of the creditors was held on June 7th, at the Official Receiver's office, 16, Cornwallis Street, Barrow-in-Furness, when the case, being a summary one, was left in the hands of the Official Receiver as trustee of the estate. The following are among the creditors:—

	£		£
Devonport Wireless Co., Ltd. ...	50	B. N. P. Wireless Co.	31
Marconi's Wireless Telegraph Co., Ltd.	60	General Wireless, Ltd.	33

E. G. NICKS, 19, Ruby Street, and 141, North Street, Bedminster, Bristol.—Receiving order made June 14th, on debtor's own petition. First meeting, July 2nd, at the Official Receiver's office, 20, Baldwin Street, Bristol. Public examination, July 25th, at the Guildhall, Bristol.

R. HAMMOND, electrical engineer, 3, The Arcade, George Street, Richmond.—Receiving order made June 14th, on debtor's own petition. First meeting, June 30th, at 29, Russell Square. Public examination, July 31st, at the Court House, Wandsworth.

RALPH SHEARD, trading as Ralph Sheard & Co., 12, Market Street, formerly 86, Station Lane, both Featherstone, Yorkshire, electrical engineer.—The public examination of this debtor was held recently, at the Court House, Wakefield. According to the statement of affairs there were gross liabilities of £172 and assets of £27. Debtor attributed his failure to lack of capital. He commenced business on his own account on October 12th last, with £42, borrowed from a friend, which was still owing. The examination was closed.

LOUIS ADOLPHUS PRIDAY, 20 & 22, Somers Road, and 5, Edmund Road, Southsea, Hants, plumber and electrician. The first meeting of creditors in the above will be held at the Official Receiver's office, Portsmouth, to-day (June 27th). Debtor's statement of affairs shows gross liabilities £182, of which £157 are expected to rank, the assets being barely sufficient to meet preferential claims. The causes of failure given by debtor are bad trade owing to competition, employing men with insufficient work on hand, law costs on summonses, and loss of goods sold under execution. The receiving order was made on debtor's own petition on June 7th. He was formerly in business with a partner, but in 1908 the partnership was dissolved and debtor took over the business upon payment of £70. To do this he borrowed about £50 from his brother (now dead), repaying about £20. Up to two years ago he was able to make a living, but since then had gradually got into debt. Public examination, August 11th, at the Court House, Portsmouth.

Company Liquidations.—TRACKLESS CARS, LTD.—A meeting of creditors was called for June 24th, at the offices of Messrs. Smithson, Blackburn & Co., 9, Central Bank Chambers, Leeds. Particulars of claims to the Liquidator, Mr. J. E. Waring, 9, Central Bank Chambers, Leeds, by July 12th. This notice is purely formal; all creditors have been or will be paid in full.

METROPOLITAN ELECTRIC WIRE CO., LTD.—First meeting of creditors and contributories, July 1st, at Carey Street, W.C.

UNI-DIRECTIONAL APPARATUS CO., LTD.—First meetings of creditors and contributories were called for June 25th, at Carey Street, W.C.

SOUTH YORKSHIRE ELECTRIC WELDING CO., LTD.—Particulars of claims to the Liquidator, Mr. G. W. Yeomans, 25, Market Place, Mansfield, by July 19th.

Dissolution of Partnership.—PHETHEAN & BRAY, electrical engineers and contractors, Newport Street, and 3, Back Exchange Street, Bolton.—Mr. W. Phetheau and Mr. C. Bray have dissolved partnership. Mr. Phethean will attend to debts and continue the business.

Trade Announcements.—Mr. G. R. ALLEN, late of the Marconi staff, has commenced business as a dealer in wireless apparatus, at 14, Station Road, Aldershot.

MESSRS. D. M. HENDERSON & CO., LTD., have removed from Moorgate to 66a, Farringdon Street, London, E.C.4.

THE ENTERPRISE MANUFACTURING CO., LTD., has been appointed agent for the London district by Specialities, Ltd., of 4, Queen Street, Blackpool.

THE NORTH-WESTERN ELECTRICAL CO., LTD., has altered its name to N.W.E., Ltd., for trade convenience. Its address is 54-55, Strand, Barrow-in-Furness.

MESSRS. WOLLETT, AIREY & CO., LTD., freight and insurance brokers in electrical and allied lines, have removed to 35, Great St. Helens, London, E.C.3.

THE STIRLING BOILER CO. has removed to 32-33, Farringdon Street, E.C.4.

THE WESTERN ELECTRIC CO., LTD., has opened a new branch office at May Buildings, 51, North John Street, Liverpool. Telegrams: "Microphone, Liverpool." Telephone: Liverpool, Bank, 8899.

CAPTAIN C. H. J. ALDWORTH, M.C., following his recent resignation as manager of the *Electrician*, has commenced business to provide advertising service, specialising in postal publicity at Rolls House, Breams Buildings, London, E.C.4. (Telephone: Holborn 4919.)

MESSRS. J. H. WOOLLISCROFT & CO., electrical and mechanical engineers and contractors, have removed to larger premises in King Edward Street, Liverpool, to obtain improved facilities for handling large rewinds and repair work, &c., with up-to-date equipment.

Catalogues and Lists.—AUTOVEYORS, LTD., 84, Victoria Street, S.W.1.—An illustrated leaflet giving revised prices of "Clix" radio plugs.

METROPOLITAN-VICKERS ELECTRICAL CO., LTD., Trafford Park, Manchester.—Descriptive Leaflet No. 976/1-1 dealing with the new equipment of the Mersey Railway Co.'s system. Fully illustrated.

MESSRS. FERGUSON, PAILIN, LTD., Higher Openshaw, Manchester.—Catalogue Sections No. 30.S9, dealing with "Type S" l.p. oil-immersed circuit breakers for remote operation; No. 74.S1, illustrating and describing oil-immersed fuses for wall or pole mounting; and No. 96.S1, treating of air-break, e.h.p. circuit breakers for outdoor installation.

FLUXITE, LTD., Simplex Works, Bevington Street, Bermondsey.—A pamphlet advertising the use of "Fluxite" in the hardening and tempering of steel articles.

RADI-ARC ELECTRICAL CO., LTD., 1, Warwick Street, W.1.—Two illustrated pamphlets describing "Major," "Broadcaster," and "Super-selector" radio receiving sets. Priced.

MESSRS. BRUCE PEEBLES & CO., LTD., Edinburgh.—Booklet No. 706.C, containing a fully-illustrated description of the company's works and products. It is divided into three parts, dealing, respectively, with the works, the manufactures, and actual installations of the firm's plant.

MESSRS. J. J. EASTICK & SONS, 2, St. Dunstan's Hill, E.C.3.—An illustrated and priced list of cycle, table, hand, &c., battery lamps, switches, plugs, lampholders, meters, small dynamotors, &c.

THE ENTERPRISE MANUFACTURING CO., LTD., Electric House, Grape Street, Shaftesbury Avenue, W.C.2.—A priced and illustrated catalogue of electric fans—desk, ceiling, &c.

THE BRITISH THOMSON-HOUSTON CO., LTD., Crown House, Aldwych, W.C.2.—A fully-priced list of electric fans of various patterns, as well as accessories—shutters and regulators.

MESSRS. SIEMENS BROS. & CO., LTD., Woolwich, S.E.18.—Catalogue 805, illustrating and describing a water pyrometer. Also a pamphlet dealing with the company's automatic telephone system, in the form of a calling dial.

METROPOLITAN-VICKERS ELECTRICAL CO., LTD., Trafford Park, Manchester.—Descriptive Leaflet No. 40/2-1. An illustrated description of high-speed induction motors.

W. T. HENLEY'S TELEGRAPH WORKS CO., LTD., Blomfield Street, London Wall, E.C.2.—A wall sheet advertising "Henley" plywood backboards for fuse-box, &c., mounting. The sheet is priced, and bears tables of metric equivalents.

MESSRS. WOOD & CARLING, Sentinel House, Southampton Row, W.C.1.—A net trade price list of electrical materials, accessories, and appliances.

Recent Contracts.—TREDEGAR (1923), LTD., Brook Street, London, have secured a contract from the Great Western Railway Co., for electric lighting installations at the railway stations of Crumlin (High Level) and Llantilleth, Wales.

THE SIEMENS & ENGLISH ELECTRIC LAMP CO., LTD., has received an order for a twelve-months' supply of "Siemens" vacuum-type lamps for the War Office.

THE GENERAL ELECTRIC CO., LTD., has recently received orders as follows:—A large order for "Osram" traction lamps for the Admiralty for use in dockyards and ships; an order for colour-sprayed "Osram" lamps for the decorative illumination of the "Sparrow Nest" Gardens, Lowestoft; for "Osram" lamps for Bootle Corporation for nine months; and for 50,000 telephone switchboard lamps for the G.P.O.

Free Imports into Italy.—The *Board of Trade Journal* has published a list of articles which may be imported into Italy duty free under the "temporary importation" system. The list includes: "Lead in pig or scrap (for the manufacture of electric cord and cables, minium, litharge, and carbonate of lead (white lead)"; "Copper wire covered with gutta-percha (for the manufacture of cables)" (until June 30th, 1925); "Porcelain boxes and steatite cylinders (for the manufacture of rotary electric valve boxes)" (until June 30th, 1925); and "Metallic materials (for the manufacture of accessories for railway and tramway vehicles)."

Catalogues Wanted.—Mr. G. Paterson, Eriean P.O., Ontario, Canada, previously engaged in this country, is taking up electrical contracting work in Canada, and wishes to receive catalogues from British makers of wiring accessories, &c.

Mr. J. Bardsley, electrician, of 91, Old Hall Lane, Withington, Manchester, wishes to receive catalogues, &c., of all kinds of domestic electrical fittings.

New French Company.—La Société pour Favoriser le Developpement du Haut Enseignement de l'Electro-Technique en France (Ecole Supérieure d'Electricité) is the name of a new organisation which has lately been formed in Paris (14, Rue de Stael) with a capital of five million fr.

Bankruptcy Offence Committee.—A committee has been appointed by the Board of Trade to consider and report upon desirable improvements in the Bankruptcy Act of 1914, particularly with regard to the provisions for the detection and penalising of offences. The members of the Committee are Messrs. E. W. Hansell (chairman), G. M. Gillett, M.P., A. M. Samuel, M.P., H. H. Spencer, M.P., A. O. Miles, F.C.A., W. H. Whitelock, and Mr. H. F. Carlile and Sir James Martin, M.B.E., F.S.A.A. The secretary is Mr. S. W. Hood, Board of Trade, Great George Street, S.W.1.

The Chinese Trade Mark Law.—It is authoritatively stated that the Trade Marks Bureau has decided to extend the period for registration of trade marks for another six months, and also that the Bureau is negotiating for the services of a foreign expert, probably a Norwegian. Foreign officials assert that the Chinese are now showing a real desire to meet foreign requirements in connection with this measure. —*Reuter* (Peking).

New Indian Companies.—Among the new electricity supply undertakings recently formed in India are the Hubli Electricity Co. of Hubli, Dharwar (Bombay Presidency), with a capital of 1,000,000 rupees, and the Amraoti Electrical Supply Co., at Amraoti (Berar), capital 1,500,000 rupees.

British Empire Exhibition Note.—From July 2nd to 15th the City of Hull is holding a "Civic Fortnight" in the Civic Hall. The effort of this important commercial centre should be of particular interest.

Central Station Batteries.—During the last 18 months the following large contracts for Tudor batteries have been placed with the Tudor Accumulator Co., Ltd.:—

	No. of Cells.	Capacity Ampere-hours.
Liverpool	280	15,980
"	282	12,960
"	274	6,910
Sydney (N.S.W.)	300	13,392
Birmingham	264	3,960
G.P.O.	220	3,960
St. James' & Pall Mall Co.	145	5,529
Kensington & Knightsbridge Co.	220	9,960
Winchester	210	1,848
Mersey Railway	255	3,792
Long Eaton	220	1,200

Railway Electricians' Wages.—On June 20th, the Electrical Trades Union presented an application for a general increase to 1s. 10d. per hour of the wages of its members employed in railway workshops in the London district. The railway companies have promised to consider the matter and state their views at a meeting which will be held in due course.

Electrical Trade of the Netherlands.—The Commercial Secretary at The Hague (Mr. R. V. Laming, O.B.E.) has forwarded to the Department of Overseas Trade the following particulars, published by the Central Bureau of Statistics at The Hague, regarding the imports and exports of electrical apparatus during the first quarter of 1924:—

Electric Lamps.

	1st quarter, 1923. fls.	1st quarter, 1924. fls.
(a) Carbon filament—		
Imports	11,000	6,000
Exports	17,000	6,000
(b) Metal filament—		
Imports	212,000	294,000
Exports	7,247,000	6,399,000
(c) Arc lamps—		
Imports	1,000	2,000
Exports	—	1,000

Insulated Electric Cables with Lead Covering.

(a) Telephone cables—		
Imports	611,000	100,000
(b) Paper-lead cables for all other purposes, including strong-current cables—		
Imports	609,000	156,000
(c) All other lead cables—		
Imports	181,000	313,000

Insulated Electric Lines without Lead Covering.

(a) Copper wire or cable, rubber insulated—		
Imports	283,000	402,000
(b) Copper wire or cable not insulated with rubber—		
Imports	45,000	70,000

Insulated Copper Wire and Copper Cables.

Exports	535,000	641,000

Electric Generators, Motors, Transformers, and Rotors.

Imports	1,112,000	1,310,000
Exports	534,000	644,000

Electrical Apparatus and Instruments.

(a) Electrical apparatus and instruments not mentioned under (b) and (c)—		
Imports	1,150,000	810,000
Exports	289,000	179,000
(b) Electrical instruments for weak current (not included under (c)).		
Imports	1,521,000	810,000
Exports	51,000	35,000
(c) Electrical apparatus and installation for wireless telegraphy—		
Imports	152,000	174,000
Exports	70,000	75,000

Motor Wagons and Locomotives for Rail Traffic.

(a) Motor wagons for electrical traction—		
Imports	106,000	240,000
Exports	1,000	—
(b) Electrical locomotives—		
Imports	1,000	4,000
Exports	—	—

The total imports were, in general, less than those of the same period in the previous year, the figures being for the first quarter of 1924 4,810,000 fl. against 5,995,000 fl. Exports were also less, the figures being 7,980,000 fl. against 8,744,000 fl., electric incandescent lamps having fallen off to the extent of 850,000 fl. France, Italy, Argentina, Australia, and Belgium were the largest customers.

Oilfield Electrification.—In the course of his speech at the recent annual meeting of the Burmah Oil Co., Ltd., the chairman (Sir John Cargill, Bart.) said that the Burmah electrification scheme, embracing all the Yenangyoung area, was justifying to the full every claim originally made for it. It had completely eliminated from this area the consumption of crude oil as fuel for drilling and operating wells and all other purposes, and the power station itself was fuelled by natural gas from the wells. The company previously burned in this way in this area every year crude oil equal to one month's throughput of the refineries, and the older the field got the greater would have been its call for such fuel. Out of the record refinery throughput the company secured a new high record percentage of marketable products at a new low record cost of fuel and loss in refining.

Lead.—Reporting on June 21st, Messrs. James Forster and Co. say:—"With a resumption of selling from America, after a very long abstention, and the prospect of large supplies from Mexico, there seems little reason for the present level of values being maintained. The Board of Trade returns for May are: Imports, 24,303 tons; exports, 2,160 tons; leaving for home absorption, 22,143 tons."

Book Notices.—BROOKHIRST SWITCHGEAR, LTD., has published an interesting little booklet on Chester, in which city the company's works are situated. Historical and descriptive, it closes with an unobtrusive advertisement of the firm in the form of a short note on the "Brookhirst" works and products. Mr. H. M. Goody, of the "Brookhirst" publicity department, is the author, and a number of charming pencil sketches by Mr. W. Mallard illustrate the text.

The Summer Number of *Punch* has just made its appearance. It is full of pictures, a large proportion of which are in colour.

Engineering Directory No. 71. May, 1924. London: Engineering, Ltd.

"British Oil Engines," by W. A. Tookey. Pp. vii+176; 24 figs. London: Percival Marshall & Co. Price 2s. 6d. net.

"Population and the Social Problem," by J. Swinburne. Pp. 380. London: Geo. Allen & Unwin, Ltd. Price 15s. net.

"Where to Seek for Scientific Facts," by Alec B. Eason, M.A. (Cantab.), A.M.Inst.C.E., A.M.I.E.E. Pp. vi+42. London: S. Rentell & Co., Ltd. Price 1s. net.—This is a useful guide to the contents of technical and scientific literature in periodicals, public libraries, &c.

Publications of the United States Bureau of Standards. Scientific Paper No. 484, "Preparation and Properties of Pure Iron Alloys: IV. The Determination of the Critical Ranges of Pure Iron-Carbon Alloys by the Thermoelectric Method." (5 cents.) Technological Paper No. 252, "The Nick-Bend Test for Wrought Iron." (10 cents.) Also an "Elimination of Waste" pamphlet, "Hollow Building Tile." (5 cents.) Washington: Government Printing Office.

The Decimal Educator. June. London: The Decimal Association. Price 6d.—It is announced in this number that a Decimal-Metric Conference has been arranged to take place at the Institution of Electrical Engineers building on July 9th. A number of well-known public men will speak, and on the following day a visit to the National Physical Laboratory, Teddington, will take place. The application of the metric scale to Ordnance Survey maps is touched upon, and other matters dealt with are "The Purchasing Power of Money," "The Metric Association (U.S.A.)," "The Collapse of the Penny," "The Standard Money Unit," &c.

International Foundry Trades Exhibition.—This exhibition was formally opened on June 19th by Mr. R. O. Patterson, the president of the Institution of British Foundrymen, at Bingley Hall, Birmingham. It is thoroughly representative of the industry. Electricity is largely used for the working exhibits, and a special installation has been provided.

United States Electrical Exports.—A preliminary report issued by the Department of Commerce shows that exports of electrical material from the United States during April were valued at 7,420,420 dollars, against 5,967,647 dollars for the corresponding month last year. Exports for the first four months of 1924 totalled 29,463,892 dollars. Shipments for the same period of 1923 were valued at 23,011,783 dollars. The heaviest increases were in transformers, power switchboards, high-pressure switching equipment and lightning arresters. Large shipments of railway motors also took place. Another item which made an unusual advance during April was electrical carbons, including electrodes. A steady increase in the exports of appliances and radio apparatus is also noticeable. *Reuter's Trade Service* (Washington).

Wanted—a Commercial Moses.—Now that most of the central-station men who attended the N.E.L.A. Convention at Atlantic City have returned to their desks, it is fitting that they should pause and calmly take stock of the commercial status of their industry. By and large, the commercial programme at the convention was notable for its recognition of the problems of developing the enormous potential market for the sale of central-station service. There was, however, a lamentable lack of definite proposal of methods for solving these problems. Viewed solely upon the merit of ultimate good to the industry, two statements were made that should serve to jolt commercial men out of their present condition of somnambulism. In discussing the costs of appliance merchandising, John F. Gilchrist declared that there is no profit in that branch of the business for either the central station or the independent dealer, and cited figures compiled from the merchandising operations of 11 companies which showed an over-all loss of 4.4 per cent. Yet an analysis of these data shows that six of the 11 companies did make money, and the 4.4 per cent. loss was caused by the heavy losses of two companies. Furthermore, it is known that there are some non-electrical dealers—namely, the department stores—which are making money out of the sale of appliances. Both they and some central-station companies have found it so profitable that they are expanding their merchandising facilities. Evidently somebody knows how to make money out of this business. The second important statement was that of Charles J. Russell, who, in his plea for power and authority for the commercial branches, commensurate with their responsibility, pointed out that much of the business gained by central-station companies of late years has been literally thrust upon them. Their growth has been due to external rather than internal causes. On these two counts the central-station industry stands indicted for failure to "cash in" on an almost unlimited field for the sale of its service. A good many excuses for this situation could be found, but the chief reason has been the backwardness of commercial men in getting together, working out concrete plans, and applying tried and proved methods for getting the business. There are companies whose commercial operations have been exceptionally successful, but the men in charge of them have been loath to assume the duties of leadership and broadcast to the industry the benefit of their experience and knowledge. What is needed now more than anything else is a commercial Moses who can point to a record of results and who can and will use the knowledge thus gained to lead his fellows out of the wilderness. Such a man should be appointed chairman of the Commercial Section for the ensuing year.—*Electrical World*.

The Royal Show, Leicester.—At the Royal Show, which is to be held at Leicester during July, Sir W. G. Armstrong, Whitworth & Co., Ltd., are showing a large quantity of road-making machinery, &c. A number of electric lighting sets suitable for country houses and similar establishments will also be shown by the company.

Social Events.—EXIDE SERVICE CONVENTION.—The annual conference of the Exide service agents took place on June 24th-25th. It was of a private nature, but a banquet was also held at the London County Club, Hendon.

On Saturday last the works staff of Messrs. Pritchett and Gold and E.P.S. Co., Ltd. (with which is associated the business of Messrs. Peto & Radford) held their annual outing, spending a thoroughly enjoyable day at Southend-on-Sea.

At luncheon Sir Archibald Gold, chairman of the company, and his co-directors, Messrs. C. R. D. Pritchett and G. R. N. Minchin, among others, made speeches. Mr. Roberson, the works manager, stated that in the whole of the company's existence it had never had a strike. A concert which disclosed exceptional talent in directions other than battery-making wound up the lunch.

British Trade-mark Applications.—The following are among the recent applications for British trade marks. Objections to any of the proposed marks may be lodged within one month from the date mentioned:—

Trylite. No. 444,351. Class 8.—Detector crystals for wireless telephonic apparatus. Alfred Gould, 45, Fountayne Road, London, N.16. June 11th, 1924.

Superzite. No. 442,196. Class 8.—A detector crystal for wireless telephony and telegraphy. Alexander C. Robbins, 113, Woodstock Avenue, Golders Green, London, N.W.11. June 11th, 1924.

Big Ben (lettering and design). No. 446,171. Class 8.—Instruments and apparatus for use in connection with wireless telephony and telegraphy. Alfred H. Watkins, The Hut, Ryton Road, Beckbury, Shropshire. June 11th, 1924.

Midite. No. 446,787. Class 8.—Detecting crystals for wireless telephony and telegraphy. Frederick H. Middleton, trading as F. H. Middleton, 13, Manette Road, London, W.1. May 21st, 1924.

Electronoid. No. 446,085. Class 8.—Detector crystals for use in wireless telephony. Daisy Winifred Porter, trading as W. H. Porter & Co., 44, Church Street, Birmingham. June 11th, 1924.

Osram. No. 447,309. Class 8.—Valves, being parts of apparatus for use in wireless telegraphy and telephony. The General Electric Co., Ltd., London, W.C.2. June 11th, 1924.

Silvervox. No. 447,714. All goods in Class 8.—The India-Rubber, Gutta-Percha & Telegraph Works Co., Ltd., London, E.C.4. June 11th, 1924.

Omni. No. 443,542. Class 8.—Apparatus for use in wireless telegraphy and telephony. John Scott Taggart, Devereux Buildings, Devereux Court, Strand, London, W.C.2. June 18th, 1924.

Q.P. (lettering and design).—Instruments and apparatus for use in wireless telegraphy and telephony. Quality Products, 29, Water Street, Hyde, Cheshire. June 18th, 1924.

Tungstalite Super-Crystal. No. 447,149. Class 8.—Detector crystals for use in wireless telephony. Tungstalite, Ltd., 47, Farringdon Road, London, E.C.1. June 18th, 1924.

Magnatone. No. 447,859. Wireless telephonic apparatus and parts thereof. Sparklets, Ltd., Angel Road, Upper Edmonton, London, N.18. June 18th, 1924.

Giltec. No. 447,905. Class 8.—Electric cables and scientific instruments. Walter Villa Gilbert, 73 & 75, Petty France, London, S.W.1. June 18th, 1924.

Rex. No. 441,701. Class B.—Electrical flat irons. Aktieselskabet Elektrisk Bureau, 17, Middelthunsgate, Christiania, Norway. (McKenna & Co., 31-34, Basinghall Street, London, E.C.2.) June 18th, 1924.

Silverstone. No. 447,187. Class 15.—Glassware for illuminating purposes. W. J. & F. H. Bull, Ltd., 73-74, Chiswell Street, London, E.C. June 18th, 1924.

Russian Turbine Contract.—The Leningrad Machine Trust has received an order from the Southern Steel Trust for the supply of a steam turbine of 15,000 h.p., at a cost of 500,000 roubles. This will be the first turbine of its size constructed in Russia.

Electric Locomotives in Italy.—The construction of electric locomotives has recently been commenced by the Società Nazionali dei Officine de Savigliano. The works have also been adapted to meet the modern demand for rolling stock for electric railways.

Telegraph Imports into the Soudan.—The imports of telegraph and telephone material into the Soudan during last year attained a value of £E32,244, as compared with only £E16,626 in 1922.

American Electrical Vehicle Exports.—During March last 32 electric commercial cars and trucks, valued at $45,376, were exported from the United States, as compared with only 16 and $26,239, respectively, in the corresponding month of 1923.

Australian Cable Imports.—The value of imports of electrical covered cables and wire into Australia during the three months ending with December last amounted to £313,039, as compared with only £176,148 in the last quarter of 1922.

For Sale.—Shoreditch Borough Council Electricity Department invites offers for surplus generating plant, together with certain steam pipes. Ayrshire Electricity Board has for disposal one 500-kW turbo-alternator and condenser, one steam balancer, and two 200-kW steam generating sets. Electrical equipment (motors, dynamos, transformers, switchgear, &c.), general plant, and building materials, at present lying at H.M. Factory, Gretna, will be sold by auction, by Messrs. Leopold Farmer & Sons, at Gretna, on July 18th. (See our advertisement pages to-day.)

Lighting and Power Notes.

Abergavenny.—ELECTRICITY IN BULK.—The Town Council has received terms from the Electricity Committee of the Hereford Town Council for a supply of electricity in bulk.

Annfield Plain (Co. Durham).—YEAR'S WORKING.—At a meeting of the Urban District Council on June 17th the Clerk submitted a balance sheet of the Council's electricity undertaking for the year ended March 31st last. During the year the expenditure on capital account was £3,409, making a total of £32,493. The receipts were £6,278, and the expenditure £5,989, showing a profit of £289. This reduced the total loss on the undertaking to £1,527. There are now 1,150 consumers, 302 having been added during the past year.

Barrow.—FIRE.—At the Corporation electricity works, on June 12th, a fire occurred due to a short circuit in a cable in the test house. Some woodwork took fire, but the Corporation fire brigade soon had the outbreak under control, and the damage done was not serious. There was, however, an interruption of the lighting and tramway services for over an hour.

Bingley.—NEW SUB-STATION.—The Urban District Council is applying to the Electricity Commissioners for sanction to the borrowing of £8,900 for the construction of a new substation. The Council receives a bulk supply of electricity from Keighley Corporation.

Canada. — HYDRO-ELECTRIC DEVELOPMENT. — Provision for further hydro-electric development in the Province of Ontario has been included in the legislative estimates. Of a total of $2,550,000, $1,700,000 is for additional generating sets at the Ontario Hydro-Electric Power Commission's Nipigon plant at Cameron Falls (Thunder Bay development), and $250,000 for two transformer stations to increase the capacity at Fort William. The remainder is to extend the steel tower transmission lines from Port Arthur to Fort William.

Cannock.—ELECTRICITY SUPPLY.—The Electricity Committee has revised its scheme for extending the cable to Heath Hayes, and has decided to apply to the Electricity Commissioners for sanction to borrow £4,243 to cover the cost. It has also decided to extend the cable 1,000 yards in order to afford a supply of electricity to 60 houses in Stafford Road, belonging to the Littleton Colliery Co. The estimated cost is £1,357, and the sanction of the Electricity Commissioners to borrow this amount is being sought.

Continental.—CZECHO-SLOVAKIA.—The construction of the Achensee power station of the City of Innsbruck will be taken in hand early in the summer, as the capitalising of the new company, created for the purpose, to the extent of 10 milliard paper crowns, has been effected. The City of Innsbruck will obtain from the new station some 8,000,000 kWh, the station's yearly output being estimated at 106,000,000 kWh. The cost of construction is estimated at 14,000,000 gold crowns, including the link line over the Achen Pass with the Bayern Werk network.

A breach in the canal supply system of the Alz power station, attributed to the abnormal weather of the past winter and spring, will necessitate the closing down of the station for several months. The exact cause and locality of the breach are unknown, and surveys are now being conducted. The losses to commercial undertakings, such as the Alexander Walker Carbide Factory and the Bavarian Nitrate Company, will, it is said, be unusually heavy.

During last year 17 new electricity supply undertakings were formed in Czecho-Slovakia. The combined capital of the concerns is 250 million crowns, in which the State is interested to the extent of 54 million crowns. The plant to be installed will aggregate 100,000 kW.

LUXEMBURG.—La Compagnie Luxembourgeoise d'Electricité is closing down its numerous small stations and drawing its supplies from a large modern generating plant.

POLAND.—The electrification of the Carpathian region is making progress. The works which are to supply power to the Boryslaw petroleum refineries, the Zagorzany paper mill, and the town of Krosno will shortly be completed. Similar works are to be constructed at Rozno with the assistance of French capital.—*Reuter's Trade Service* (Warsaw).

Denby and Cumberworth.—ELECTRICITY SUPPLY.—The Urban District Council has decided that the Yorkshire Electric Power Co. shall take over the electricity supply in the area of the Council.

Exeter.—INQUIRY.—An inquiry was conducted by Col. T. C. Ekin, on behalf of the Electricity Commission, on June 17th, into rival applications by the Topsham Electricity Supply Co., Ltd., and the Exeter City Council for Orders authorising the former to supply electricity to Topsham, and the latter to Topsham, Ide, Pinehoe, and Alphington. The result of the inquiry will be published in due course.

Faversham.—NEW PLANT.—The Town Council has decided to make extensions to the plant at the electricity works at an estimated cost of £11,825. It is proposed to install two semi-Diesel heavy oil engine-driven generating sets not exceeding 250 kW capacity.

Harrogate.—LOAN.—In connection with the agreement with the Knaresborough Urban District Council for a supply of electricity to that district, the Corporation is applying to the Electricity Commissioners for sanction to the borrowing of £5,100 for a new high-pressure main from Starbeck to Knaresborough.

India.—WATER-POWER DEVELOPMENT.—Development of irrigation and power projects on the Cauvery River in India has been made possible through the settlement of the dispute over the partition of the waters of this river which has been reached by the Government of Madras and the native State of Mysore. The Madras Government will construct the Mettur reservoir for irrigation purposes, and the State of Mysore will proceed with the construction of the Kannambada dam, the water to be used partly for irrigation purposes and partly for increased power facilities for the Mysore Electrical Department.—*Commerce Reports.*

Indo-China.—ELECTRICITY SCHEME.—Included in the new work planned by the Compagnie des Eaux et d'Electricité de l'Indo-Chine is a power station at Pnompenh and the laying of the underground transmission cables between Cholon and Saigon. The work is to be completed in four years.

Irish Free State.—LONDONDERRY.—The strike of municipal employés, which commenced early in May, was recently settled. The men employed in the power station accepted a wage agreement, and the electricity supply has been resumed.

Leeds.—YEAR'S WORKING.—The report on the City electricity undertaking (manager: Mr. C. Nelson Hefford) for the year ended March 31st last shows a total revenue of £538,704, as compared with £525,767 in 1922-23. Working expenses amounted to £205,135 (£175,450), leaving a gross profit of £333,569 (£350,317). Income tax and loan charges absorbed £225,010, and there was a net surplus of £108,559, as compared with a profit of £134,935. The capital expenditure during the year amounted to £260,676, and the amount of electrical energy sold was 86,908,370 kWh, an increase of 14,971,222. The capacity of the plant has been increased by the addition of a 12,000-kW turbo-alternator, but reduced by the discarding and sale of obsolete machinery with a capacity of 6,000 kW, and therefore the capacity of the station is 57,000 kW compared with 51,000 kW at the end of the previous year. Additional turbo-alternators are on order with capacities of 10,000 kW and 15,000 kW respectively, together with the necessary boilers, switchgear, &c., which will increase the capacity of the station to 82,000 kW.

Leigh (Lancs.).—YEAR'S WORKING.—The report of the borough electrical engineer, Mr. J. B. Hudson, on the working of the electricity undertaking for the year ended March 31st last shows a total revenue of £34,272, as compared with £35,692 in the previous year. Working expenses amounted to £18,437 (£18,856), leaving a gross profit of £15,835 (£16,856). After deducting capital charges, there was a net surplus of £1,492, as against a profit of £5,990 in 1922-23. The capital expenditure during the year amounted to £6,286, making a total of £158,076, and the amount of electrical energy sold increased from £3,269,396 to 3,773,975 kWh.

London. — SUB-STATION EXPLOSION.—An explosion occurred on the night of June 17th at the Elephant and Castle sub-station. Thomas Clark, an electrician, was found unconscious near one of the machines with his clothing in flames. He was removed to Guy's Hospital. The explosion was apparently due to a fuse, and the supply of electricity was only temporarily affected.

Marlborough.—ELECTRICITY CHARGES.—In connection with the electric lighting scheme, the Town Council has decided to commence with a charge of 10d. per kWh for lighting, and 5d. per kWh for power.

Nantwich.—ELECTRICITY SUPPLY.—At a recent meeting of the Urban District Council, Mr. Davies, of the Gwynedd Trust, Ltd., outlined the company's scheme for a supply of electricity for South Cheshire. He stated that the company would act as distributors for the North Wales Power Co., and negotiations had been entered into with 30 local authorities, 14 of which had given sanction. Pending completion of the new works, electricity would be obtained from the Mersey Power Co., and for private lighting the maximum price had been fixed at 9d. per kWh., with 6d. per kWh for street lighting, and 4d. for small power users. The Council referred the matter to the Electricity Committee.

New Zealand.—CHRISTCHURCH.—The City Council proposes to raise a loan of £500,000 for extensions to the electricity supply network.

North Berwick.—ELECTRICITY SUPPLY.—The Town Council has intimated to the North Berwick & District Electric Light and Power Co., Ltd., that in the event of its offer of £10,000 not being accepted for the undertaking, it is proposed to take over the works in terms of the agreement whereby the Council can acquire it after 10 years.

Portsmouth.—LOAN.—The Town Council has applied to the Electricity Commissioners for sanction to a loan of £35,000 for cables, &c., in connection with the supply of electricity to Chichester Corporation and to Fareham.

Preston.—NEW POWER STATION.—Progress is being made with the erection of the power station on the banks of the Ribble. One generating set is complete, but it is not expected that the official opening will take place before October. A heavy demand for current is anticipated when the station is in full running order. Contracts for an electricity supply have already been arranged both with industrial firms and householders, and negotiations of an important character are in progress. If they are satisfactorily completed the Corporation will have to consider enlarging the station at an early date.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

SKELTON AND BROTTON.—Lighting: 4½d. per kWh (slot meters 5½d.). Power: 1½d. per kWh.

LLANDRINDOD WELLS.—Lighting: From 1s. to 11d. per kWh.

BINGLEY.—Lighting: From 7d. to 6½d. per kWh.

Ramsbottom.—ELECTRICITY SUPPLY.—The Lighting Committee of the Urban District Council has decided that the present arrangement with the Lancashire Electric Power Co. as to the lighting of the district shall be renewed for a period of one year.

Saltcoats.—STREET LIGHTING.—The Town Council has requested the Kilmarnock Corporation to submit a scheme for ...nting the streets by electricity.

Sheffield.—ELECTRICITY EXTENSIONS.—The Electric Supply Committee has approved of electricity extensions at a total estimated cost of £6,207.

Southend-on-Sea.—LOANS.—The Town Council has decided, subject to the approval of the Finance Committee, to apply to the Electricity Commissioners for sanction to loans of £20,000 for feeders and distributing mains, and £25,000 for services.

Sunderland.—MAINS EXTENSIONS.—The Electricity Committee has recommended to the Town Council that extensions to mains be carried out at an estimated cost of £4,889.

Taunton.—LOAN.—The Town Council is applying to the Electricity Commissioners for sanction to the borrowing of £5 000 for mains and services.

United States.—NEW YORK STATE.—According to *Power*, a scheme is in hand to gradually link into one super-power system all the principal companies supplying electricity in the State of New York. A link of considerable importance in this chain will be forged when the present plans of the Northern New York Utilities, Inc., of Watertown, are realised. This corporation distributes electricity in six counties. It has recently acquired the property and facilities of the Rome Gas & Electric Co., and is extending its system to where a physical connection with the Adirondack Power & Light Co. would be possible. The Watertown company is to expend some $1,400,000 in improvements and extensions, the most important of which is the connecting up at Altmar, Oswego County, with the lines of the Niagara, Lockport & Ontario Power Co., thus affording an interchange with Niagara and northern New York. Simultaneously with the development by the Northern New York Utilities, Inc., the Canton Electric Light & Power Co. (St. Lawrence County) has increased its capital from $38,000 to $150,000, and the St. Lawrence Transmission Co. and the Oswegatchie Light & Power Co. are seeking the permission of the Public Service Commission to construct large generating plants in the town of Gouverneur on the Oswegatchie River.

Worcester.—YEAR'S WORKING.—The report of the Corporation electricity undertaking (electrical engineer: Mr. C. M. Shaw) for the year ended March 31st last records a net profit of £2,714. The total income amounted to £46,897, as compared with £45,659 in 1922-3, being an increase of £1,238. Working costs were £28,384, leaving a gross profit of £19,333. At the Hylton Road works during the past year all boilerhouse plant has been thoroughly overhauled. The second thorough overhaul of No. 1 turbo-alternator, which was installed in 1913, has been undertaken since Christmas. This set has been in regular service since 1920, and with the exception of a little wear in the bearings and couplings (which does not justify immediate renewal) the plant showed practically no signs of wear. Much new plant has been installed and many improvements carried out. 211 new consumers have been connected and extensions made to 112 existing installations. The electrical energy sold during the year totalled 6,200,183 kWh, compared with 5,670,247 kWh in the previous year. The costs of production remain practically unchanged. The total works costs for the year were 1.06d. per kWh sold, compared with 1.04d. last year.

Tramway and Railway Notes.

Australia.—VICTORIA.—The Victorian Railway Commissioners have requested the Railways Standing Committee to approve of the conversion of the Ringwood to Croydon section from steam to electricity as soon as possible so that the work may be done in conjunction with the electrifying of the outer circle line from Camberwell to Ashburton. In the Railway Loan Application Act passed by Parliament recently, provision is made to cover the cost of this work, and as soon as it has been approved by the committee the work can be commenced. Later the Railways Standing Committee will inquire into the proposal by the Commissioners to extend the electrification to Lilydale, and to electrify the Ringwood to Ferntree Gully line.—*Industrial Australian and Mining Standard.*

Brazil.—ELECTRIFICATION SCHEMES.—A contract has recently been signed for the electrification of the tramways in the suburbs of Nictheroy on the lines of the Cia. Tramway de Sao Gonçalo. The work is being carried out by the Cia. Cantareira.

It is also proposed to electrify a section of the Oeste de Minas railway between Barra Mansa and Augusto Pestana.

Chile.—RAILWAY ELECTRIFICATION.—According to *Commerce Reports*, plans for the electrification of the Transandean Railway *via* Juncal have been submitted to the company's directors in London for approval. The company has already petitioned the Government for authority to erect a transmission line, but as further legislation will be necessary before this petition can be granted, no action will be taken until the Chilean Congress meets.

Continental.—GERMANY.—The brakes of a tramcar snapped whilst the car was descending a steep incline at Iserlohn, near Dortmund, on June 18th. The car left the rails, crashed against the iron railings of a factory, and turned over. The car was completely smashed, and a number of passengers were killed or injured.

Dearne Valley Light Railway.—Trial runs on the Dearne District Light Railway were made last week, and it is expected that the new system, which will link up Wombwell, Wath, Bolton-on-Dearne, and Thurnscoe with the Barnsley, Mexborough, and Swinton tramways, will be opened shortly. Mr. J. M. Coutts, of Paisley, is the manager of the undertaking.

Heywood.—LOAN SANCTIONED.—The Electricity and Tramways Committee has received the sanction of the Minister of Transport to the borrowing of £5,000 for the purposes of the tramway undertaking.

Liverpool.—ALL-NIGHT SERVICE.—The Tramways Committee has recommended to the City Council that for a period of three months a twenty-minute experimental service be run on the principal tramway routes from midnight to 1 a.m. at double the ordinary fares, and an hourly service from 1 a.m. to 5 a.m. at treble the ordinary rates.

Rochdale.—YEAR'S WORKING.—The working of the tramways during the past year resulted in a total revenue of £165,538. Working expenses amounted to £117,766, leaving a gross profit of £47,592. Interest on loans amounted to £13,933, income tax, £6,138, sinking fund £8,834, rent of leased lines £7,205, and a payment to Heywood Corporation for receipts on its section £3,195, leaving a net profit of £9,535.

South Shields.—FARES.—The Town Council has decided to shorten the distances of the penny and three-halfpenny fare stages. The change, it is estimated, will increase the revenue by £4,000.

Telegraph and Telephone Notes.

Greece.—TELEGRAPH CONCESSION.—The renewal to the Eastern Telegraph Co. (British) of certain rights not enjoyed by other foreign telegraph companies is the subject of negotiations with the Greek Government.

India.—RADIO SERVICE DISCONTINUED.—The direct radio-telegraph service by means of which the Foreign Office used to send information from this country to India was discontinued last month, the reason being that "the time occupied was totally incommensurate with its value either to the Post Office or to the senders."

Portugal. — RADIO-TELEGRAPHY.—The utilitarian side of radio-telegraphy in Portugal is, according to the report of the British Chamber of Commerce at Lisbon, in a chaotic condition, and prejudicial to the commerce of that country. Great delays are experienced in communicating with ships, and little attention is paid to ships calling up Portuguese stations with urgent messages for shipping agents. "The wireless service of the country," the report asserts, "is so bad that undoubtedly some day there will be a serious maritime disaster owing to the lack of attention paid at the wireless stations" to calls. There are three principal stations in the country—at Leixoes; at Lisbon, worked by the Post Office; and a powerful Portuguese naval station at Monsarto. The first two are supposed to deal with shipping traffic, but their installations, though apparently technically capable of dealing with shipping, are, in practice, unable to do so, owing to lack of trained staff. The naval station is not available for shipping work.

Rhodesia.—RADIO-TELEGRAPHY.—It is proposed to connect Salisbury with Pretoria, South Africa, by means of a 6-kW duplex radio installation. At present all aerial traffic from Salisbury and Beira and territories to the north and east, which now communicate with the south by way of Salisbury, must be retransmitted at Bulawayo. The proposed direct transmission would enable Bulawayo to concentrate more

freely on Northern Rhodesia and Congo traffic, which would result in a saving of 50 per cent. in such telegraph work and considerably relieve the telegraph stations at Johannesburg and Cape Town.—*Commerce Reports.*

Turkey.—CABLE DISPUTE.—A deadlock has arisen between Turkey, Greece, and the British-owned Eastern Telegraph Co., which controls the cables of the Mediterranean. Before the Greek occupation of Smyrna in 1920 the Eastern Telegraph Co. collected certain terminal charges and paid them over under agreement with the Turkish Government. When the Greeks took possession of that port the company continued to collect the charges in the ordinary way, but paid the money into a suspense account pending an arrangement with the *de facto* Government. After the Turkish re-occupation in 1922 there arose the question as to the disposal of this fund, which amounted to more than £100,000. The company was anxious to get rid of its obligation, but both Turkey and Greece claimed the whole sum. A short time ago the Turks, having failed to obtain satisfaction, closed all the offices of the Eastern Telegraph Co. in Turkey, and nothing seems likely to induce them to allow the company to resume its work. Neither Greece nor Turkey appears willing to bring the matter before the English Courts, and in the opinion of the company the only way out is to have the question settled by international arbitration.—*The Times.*

United States.—TELEPHONING TELEGRAMS.—The practice of delivering telegraph messages in a nearby town by telephone is held by the Ohio Public Utilities Commission to be a more efficient method than to establish a branch telegraph office therein.

TELEPHONE OPERATORS.—About 20,000 telephone operators are employed in the 134 telephone exchanges of the New York Telephone Co. and in the Long Lines Department of the American Telephone & Telegraph Co. in New York City. To these should be added some 20,000 additional operators employed by private concerns, making a total of over 40,000 operators serving one city.—*T. & T. Age.*

Radio Notes.

Amateur Transmitters. — NEW RESTRICTIONS.—Amateur transmitters in this country may no longer establish communication with the United States and other distant countries, new limitations to the power to be used by experimenters having been prescribed by the Post Office. The conditions applying to experimental sending licences have been revised with a view to reducing risk of interference with Admiralty stations and with the reception of broadcast programmes. The power to be used in transmission is now definitely limited to 10 watts, and "spark" transmission is expressly forbidden. Messages may now only be transmitted to stations in Great Britain and the North of Ireland which are actually co-operating in a licensee's experiments. There is no reason why experimenters should not be able to get in touch with places on the Continent.—*Daily Mail.*

Belgium.—WAVE-LENGTH CHANGE.—On the 23rd inst., the wave-length employed by the Brussels broadcasting station was reduced to 262 metres from 265 metres. It is hoped by this slight alteration to eliminate a certain amount of interference. Should the experiment be successful the new length will be permanently adopted.

Germany.—NEW BROADCAST RECEIVER.—A high postal official of Munich demonstrated on June 17th an invention which, it is claimed, enables telephone subscribers to listen to concerts, speeches, &c. It is reported that the second act of the "Valkyrie," played at the Munich State Opera House, was heard distinctly through a small apparatus attached to an ordinary telephone instrument. It is added that the invention will be put on the market in October.—*Reuter* (Berlin).

New Licences.—UNIFORM FEE.—At the annual meeting of the British Broadcasting Co., which now has about 1,500 members, Lord Gainford, the chairman, announced that the company proposed to retain the trade mark for use on British parts only, when at the end of the year the new conditions came into operation, and that there was an excess of revenue over expenditure up to March 31st last, amounting to £3,811. The Postmaster-General had the right to introduce a uniform licence of 10s. from the beginning of next year. The Post Office had pointed out that about 300,000 15s. licences would need renewal in October of this year, and had asked if the company would agree to a uniform licence being adopted at the beginning of October. The board had recommended the adoption of a uniform licence fee, not from October 1st, but from July 1st, so that whether a listener were buying a complete set or making up his own set from parts, he would pay the same fee, but the restrictions against the use of foreign parts would be maintained until the end of this year.

In addition all tariffs would be abolished from the same date. The approval of sets by the Post Office would also automatically cease. Strenuous efforts had been made to secure some measure of protection for the broadcast wave band against interference from other transmissions, and he understood that something definite might result in a short time. A regular campaign, chiefly educative, had also been conducted to overcome the bugbear of oscillation. The Board of Education and educational authorities shared the company's ideas as to the future of broadcasting to schools. They were restricted in the broadcasting of news, but they expected to secure certain additional privileges in that respect. The monthly increase of licences had been systematically maintained. The actual number of licences in force at the end of May amounted to 800,000.

New Stations.—CHELMSFORD.—Prolonged tests were made last week from the B.B.C. high-power experimental station at Chelmsford on a 1,800-metre wave length, the call sign used being 2BS. The company hopes to open the station on July 1st.

LIVERPOOL.—The call signal of the new Liverpool relay station, which was opened on the 11th inst., is 6LV, and its wave-length is 318 metres.

Reproduction of Music.—SCOTTISH INNOVATIONS.—The Edinburgh Corporation city architect and electrical engineer are to report on the possibility of installing a radio receiver and loud speaker in the Portobello bandstand.

Receiving sets have been installed in the Clyde lighthouses for the benefit of the keepers.

Contracts Open and Closed.

(The date given in parentheses at the end of the paragraph indicates the issue of the ELECTRICAL REVIEW *in which the "Official Notice" appeared in our advertisement pages.)*

Open.

Argentina.—BUENOS AIRES.—August 25th. Department of Navigation and Ports. Electrical material, including insulators and insulating material, wires and cables, electric lamps and holders, telephone bells, mouthpieces and cords, dry cells, &c.*

Australia.—PERTH.—August 15th. Government of Western Australia. One 12,500-kW turbo-alternator with condensing plant. Water-tube boilers, economiser, fans, chimney, &c. Also coal and ash plant. (June 20th.)

Belgium.—July 8th. Municipal authorities of Petit Brogel (Province of Limbourg). Establishment of a l.p. electricity distribution system in the town. Particulars (Cahier des Charges) for 25 fr.

July 22nd.—The Société Nationale des Chemins de Fer Vicinaux, 14, Rue de la Science, Brussels. Overhead electric equipment in connection with the electrification of the Dilbeek-Schepdael section of the Brussels-Ninove local railway. Particulars for 5 fr. from 48, Rue Montoyer, Brussels.

July 2nd.—The Belgian State Railway authorities at La Salle Madeleine, Brussels, are inviting tenders until July 2nd for the supply of a large quantity of miscellaneous electrical apparatus, including 2,000 porcelain circuit-breaker covers, 3,300 4-terminal boxes, and 4,890 quick-break single-pole commutators. Particulars (Cahier des Charges Special No. 415) for 3 fr. 75 c. from Office de l'Electricité, 25, Rue de la Charité, Brussels.

Bingley.—July 11th. Electricity Department. E.h.p. switchboard and l.p. switchboard. (June 20th.)

Bradford.—July 12th. Town Council. Electric lighting installation for 302 houses, various sites, for Town Council. Particulars from city architect, Town Hall, Bradford.

Canada.—August 5th. City of Toronto, Department of Works. Supply and installation of three centrifugal sewage pumps, direct-connected to electric motors.*

Cheadle.—July 2nd. Cheadle and Gatley Urban District Council. Switchgear for sub-stations, Bird Hall Lane, Cheadle. Particulars from Mr. C. H. Wordingham, engineer to the Council, 33, Brazennose Street, Manchester.

China.—HANKOW.—September 30th. Hankow Water Works and Electric Light Co. Nine 1,000-kVA transformers for 2,300/6,000 volts; six 210-kVA transformers for 2,300/400 volts.—*Reuter's Trade Service* (Hankow).

Dublin.—June 30th. Electricity Department. Portable air compressor and pneumatic boiler scale tools for Pigeon House electricity works. City Electrical Engineer, Fleet Street, Dublin.

Egypt.—CAIRO.—October 30th. Egyptian State Railways, Telegraphs and Telephones. Automatic c.b. telephone exchange equipment and sub-station subscribers' apparatus at Cairo. (June 13th.)

Greenock.—June 30th. Corporation. Electric lighting installation at 74 houses. Plans from burgh surveyor, Municipal Buildings.

Grimsby.—July 5th. Corporation Electricity Department. Two e.h.p. truck-type cubicles, a 100-kVA transformer, l.p. switchgear, cable work, &c. (June 20th.)

July 5th. Electricity Department. L.p. cables for 12 months. (June 20th.)

Horbury Bridge (Yorks.).—July 1st. Electric lighting installation, St. John's Church and parish hall. The Vicar.

(Continued on page 1051).

The Highfield-Calverley Transverter.

The English Electric Co.'s Novel Exhibit.

PROBABLY the most novel exhibit at the British Empire Exhibition is a remarkable piece of apparatus on the stand of the English Electric Co., Ltd. By combining the words "transformer" and "rotary converter," the machine was named so as to indicate the part it plays, the primary function for which it was designed being the conversion of alternating current into direct current at exceedingly high voltage. It is regarded as being likely to bring about fundamental changes in the method of transmitting electricity over long distances, for while the advantages of a.c. in respect of generation and distribution are so great as to preclude its being superseded by any other system, it is apt to be forgotten that d.c. is far superior to it for transmission purposes.

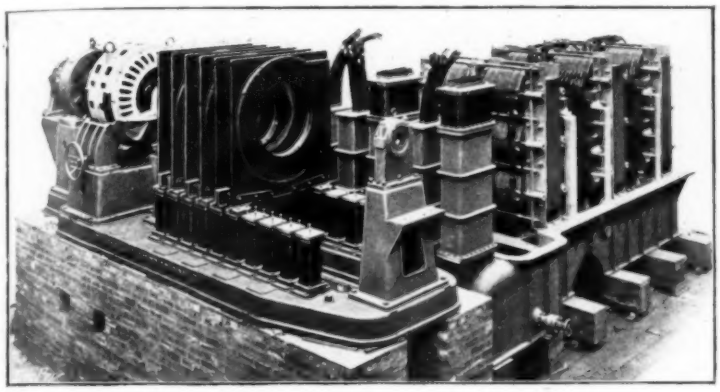


Fig. 1.—The Transverter in course of Erection.

The transverter was patented in the names of Messrs. W. E. Highfield and J. E. Calverley, following research work carried out by them at the Dick, Kerr works at Preston. In 1918 the first plant was constructed with a nominal rating of 250 kW, and so successful did it prove that the construction of a pair of 2,000 kW machines was commenced, one of which is to be seen at Wembley.

When fed with 3-phase 50-cycle a.c. at 6,600 volts, it will deliver a d.c. amperage of 20 at 100,000 volts. There are 10 commutators, the brush speed is 1,000 r.p.m., and all the windings and connections are accessible. The sister d.c./a.c. machine is provided with a brush-driving motor that is made larger than is necessary in order that it may correct the power factor of the a.c. network, while the frequency at the delivery end of the line may be different from that of the source of supply. It should be recognised that the capabilities of the transverter go beyond those of the transformer-converter combination. It may be wound for two or more phases and for any reasonable periodicity or voltage.

In converting from a.c. to d.c. three operations generally have to be carried out, *viz.*:—(1) Voltage transformation, (2) phase multiplication, and (3) commutation. The first provides for the desired adjustment of voltage; the second for obtaining a constant (*i.e.*, non-pulsating) voltage on the d.c. side; and the third for conversion. The object of phase multiplication is to provide a number of winding elements forming together a symmetrical closed ring, which has travelling round it a constant electromotive force. Both the voltage transformation and the phase multiplication are carried out in a static piece of apparatus, resembling in construction a number of polyphase transformers grouped together; from this are taken the connections to the commutators, the segments of which are stationary, so that the only moving part of the apparatus is the rotating brush gear with its small driving motor.

To produce the result indicated above, the phase multiplication must proceed so that there results a number of elements having phase positions uniformly spaced apart in order that the elements may be joined in series to produce a complete closed winding, similar to that of a Gramme-ring armature from which uniformly spaced tappings may be taken off to commutator segments.

For instance, if 3-phase transformers are employed, one of them will have primary windings, each consisting of turns of one phase only and on each core will be provided two secondaries, one for direct and the other for reverse connection, so as to produce six secondary phases spaced 60 electrical degrees apart. Another transformer will have on each core a primary winding comprising turns from two of the fundamental phases so that the flux in each core is out of phase by a definite amount with the flux in the corresponding core of the first transformer. Accordingly, by putting two secondary windings on each core of the second transformer a further set of six equally-spaced phases can be produced, their phase positions being located between those of the first six phases.

By continuing this process any number of phases forming a multiple of six can be produced and it is only necessary to make appropriate selection of the numbers and phases of the primary turns in order that the angular displacement between adjacent secondary phases may be uniform. Thus, there results from three primary phases, which may be represented by three radiating vectors at 120 deg., a secondary phase system comprising some multiple of six phases which are represented vectorially by radiating vectors spaced apart by a uniform angle, the value of which is 60 deg. divided by some whole number. Therefore, while a closed mesh winding on the primary side would be represented as a triangle, a similar winding on the secondary side would appear as a polygon, the number of sides being some multiple of six.

The top half of fig. 2 shows the vectors representing the

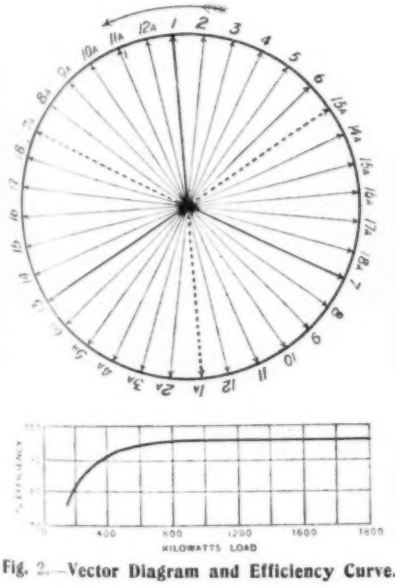


Fig. 2.—Vector Diagram and Efficiency Curve.

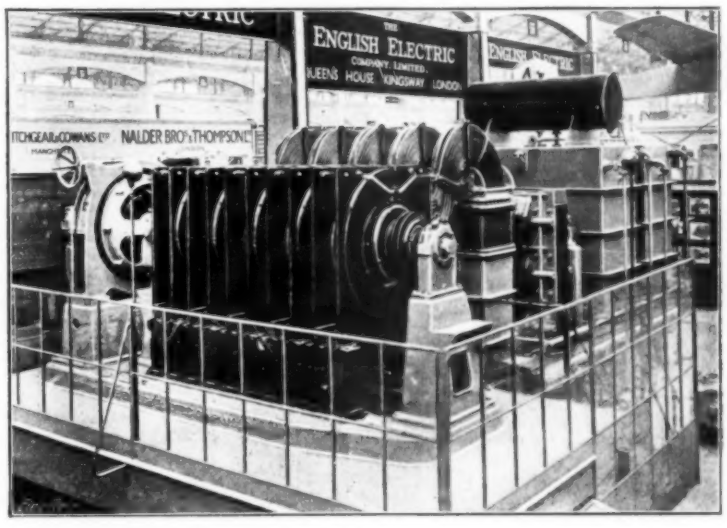


Fig. 3. The Transverter at Wembley.

transformer induced e.m.f.'s. There are 18 magnetic cores with two secondary windings on each, one connected in the reverse direction to the other. There are, therefore, 36 separate phases spaced 10 electrical degrees apart. The projection of any vector to the vertical line will give the instantaneous value of the induced e.m.f. at the instant considered. The number at the point of each vector represents the phase number of the secondary winding, and each number is directly opposite a similar number with the affix "A." These represent the two secondary windings on the same core, but wound in opposite directions.

The brushes are driven in step with the rotating field of the transverter by a synchronous motor (provided with its own direct-coupled exciter) of the self-starting type; it forms a perfect automatic device for maintaining the correct relationship between the brush gear and the incoming supply. The stator of the motor can be rocked so that the position of the brush gear driven by it may be varied.

The transverter, besides being completely reversible, is also capable of converting a d.c. of one voltage to a d.c. of a different voltage. To do this it is necessary that, in addition to the closed-ring winding and commutator system already described, there shall be on the transformer cores a second closed-ring winding similar to the first except as regards number of turns, size of wire, and insulation, and this winding will also be connected to commutating gear similar to the other and mounted so that the brushes are rotated synchronously with those of the first gear. The two windings then form the main windings of the apparatus, one receiving

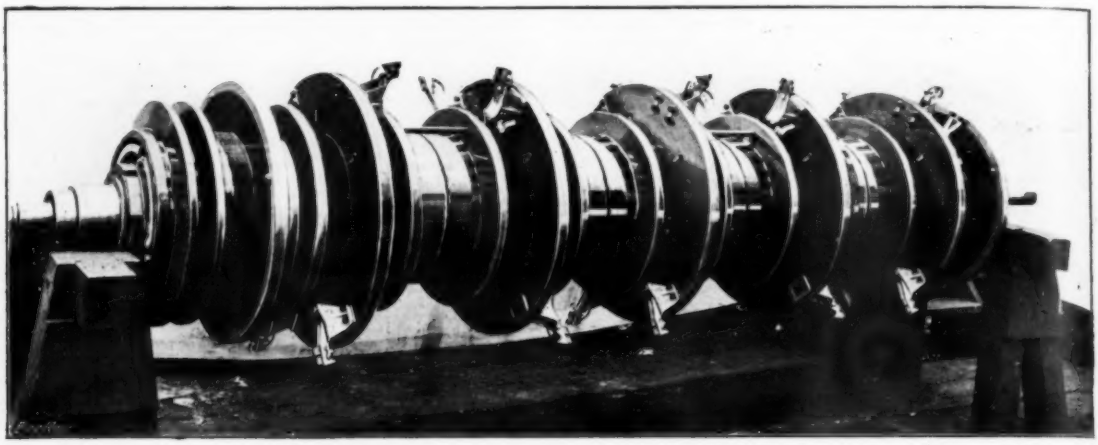


Fig. 4.—The Brush Gear and its Driving Shaft.

Having obtained the phase multiplication and the closed ring winding resulting therefrom with the tappings led off to segments of a commutator, we have conditions for the production of electromotive forces and the flow of current similar to those in a d.c. armature, so that by moving appropriately spaced brushes over the surface of the commutator at the correct speed, direct current can be obtained at a non-pulsating voltage.

In order to lower the speed of rotation of the brushgear, instead of having one segment for each tapping, each tapping is connected to two or three segments spaced uniformly round the commutator, analogous to the method employed in multipolar d.c. armatures. The use of fixed commutators gives the

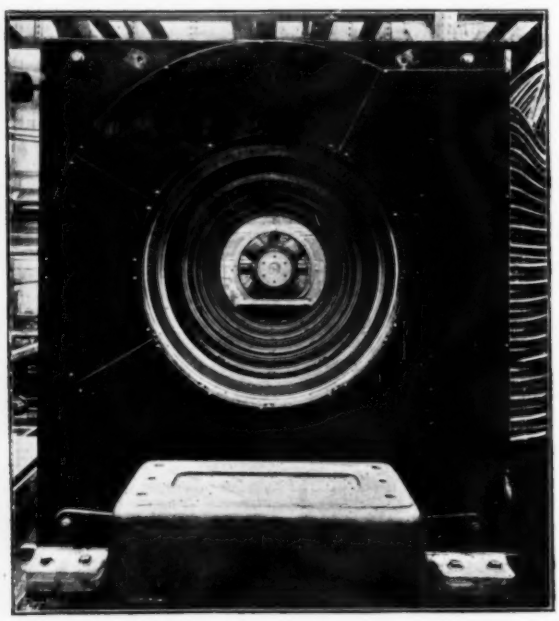


Fig. 5.—Commutators without Brush Gear.

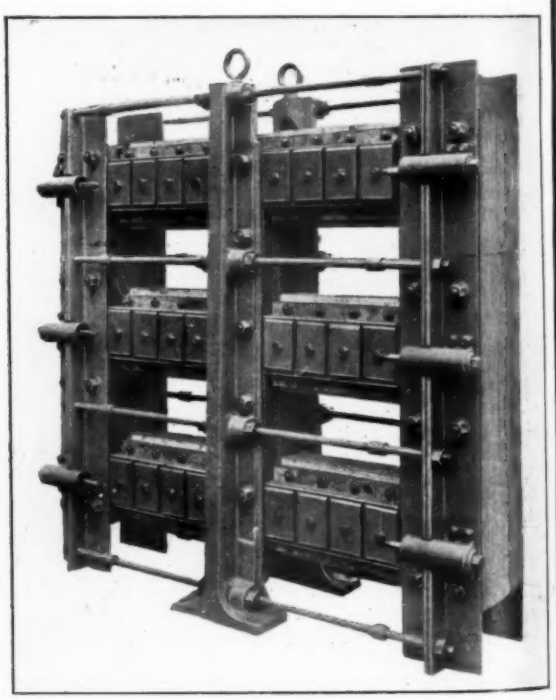


Fig. 6.—A Six-phase Transformer Core.

designer more freedom, since there are no mechanical stresses due to rotation to provide for; all the windings may be immersed in oil so that the vital parts of the transverter have all the advantageous characteristics of a static transformer. All the secondary coils may be made identical in form and number of turns so that, although they may be very numerous in a transverter giving a high voltage on the d.c. side, their formation and connection become simple.

Additional sets of secondary windings may be wound on the same cores and connected to their own commutators, each entirely separate from the others, but all identical in characteristics because they all undergo the same rate of change of flux at any instant. By connecting the brushgear in series very high terminal voltages can be obtained.

energy and the other delivering it. The primary winding can accordingly be reduced to very small dimensions and need only carry a small a.c. sufficient to provide the excitation of the transformer cores. This arrangement gives the advantage that neither of the direct current systems is required to supply magnetising current, so that the ampere turns of the input system are exactly balanced by the ampere turns of the output system and distortion of the current in these systems with its consequent disturbance of commutation is avoided.

High efficiency is essential in transforming and converting apparatus, and the lower portion of fig. 2 shows the efficiency curve of a 2,000-kW transverter. It is not contemplated to build such machines for a lower d.c. pressure than from 1,500 to 3,000 volts.

Some of the Exhibits at Wembley.

Messrs. A. Reyrolle & Co., Ltd.

(Stand No. 6, Avenues 8 and 9, Bays 20 and 24.)

The products of these switchgear specialists are too well known to need any introduction, but as an indication of the activities of the firm it may be mentioned that since the impressions of a visit to its Hebburn-on-Tyne works were recorded in our issue of January 12th, 1923, entirely new works have been built and equipped for the production of machined parts for use in the old works which are now devoted solely to assembly. It is typical of the firm's methods that 12 months after the foundations of the buildings were commenced the new works were engaged in production, as shown in the first of the accompanying illustrations; from a central bay the material flows to the machine tools in the various bays on either side, one of which is shown in fig. 116.

The chief feature of the exhibit, which was recently inspected by a party of engineering Press representatives, is

Fig. 116.—A Portion of the new Reyrolle Factory.

the manner in which the company has endeavoured to convince the public of the advantages of metal-clad apparatus. The principle of metal-cladding originated in 1908, and was immediately adopted by Messrs. Reyrolle as their basic principle of switchgear design. Such gear was early appreciated, the typical example of modern British practice in the exhibition power station, which was illustrated in our May 2nd issue, being a particularly happy choice.

After luncheon, by the courtesy of the authorities concerned, the party inspected the switchgear now in course of erection in the King's Road power station of the St. Pan-

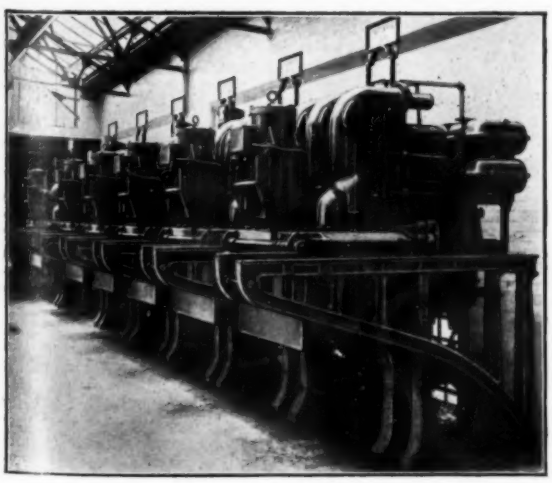


Fig. 117.—New Reyrolle Switchgear at St. Pancras.

cras Borough Council. This board of 23 11,000-volt, 3-phase panels, a portion of which is illustrated in fig. 117, owing to the small space available, is arranged in two tiers. It is remote-controlled and electrically-operated with duplicate busbars, the individual oil circuit breakers having a breaking capacity of 450,000 kVA. There are six generator panels controlling an aggregate capacity of 33,500 kVA, 10 outgoing feeder and four motor-converter panels with Merz-Price and overload protection. One bus-bar coupler and two bus-bar reactance panels with overload protection are also being installed, and full indicating, synchronising, and metering equipment is fitted, and the general lay-out is one of neatness and accessibility.

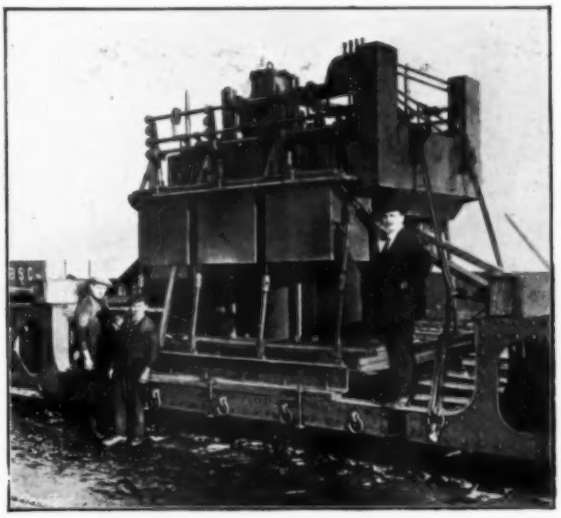


Fig. 118.—Reyrolle "M"-Type Armourclad Switch.

A visit was also paid to the Charing Cross, West End, and City Electric Supply Co., Ltd., and the City of London Electric Lighting Co., Ltd., jointly owned important Cannon Street sub-station to see metal-clad switches in commission. That building sites are valuable in the City of London is reflected in the space allowed for the switchgear in this underground sub-station. In what is really a long corridor are installed twenty 11,000-volt, 3-phase direct-operated panels; 15 of them are the property of the Charing Cross Co., and include six Merz-Price feeder panels, two overload feeder panels,

Fig. 119.—Reyrolle Flameproof Gate End Switch.

Fig. 120.—Reyrolle Flameproof Circuit Breaker.

and four bus-bar coupling and reactance panels with overload protection. The remaining five belong to the City of London Co., and include three feeder panels with split-conductor and overload pilots, one feeder panel with overload protection, and a metering and bus-bar-coupling panel. This switchboard constitutes a most important interconnection between the generating stations of the two companies, the total generator capacity connected being of the order of 99,000 kVA. That much money has been saved in building construction alone is quite evident, but the small space occupied by such gear is a no less easily recognisable characteristic than are its

reliability, robustness, accessibility, ease of erection, and safety of both the operators and the whole system of which it forms a part.

At Wembley a representative range of products is exhibited,

Fig. 121.—Reyrolle Distribution Board.

from power station, mining, and industrial gear to apparatus for domestic service, including such small items as switch-plugs and sockets for portable devices; the contacts are in deep recesses of insulating material, so that current can be broken on the plug, which, in fact, is a d.p. switch the arc of which is quenched in a metal-clad enclosure. Arrangements have been made to demonstrate the action of the various items, the large switches being made to function in conjunction with a control board at one end of the stand, above which is the familiar automatic diagram that indicates the operation of every panel in detail, the indicators being electrically operated by auxiliary switches on the panels. A model has also been constructed to demonstrate the diverter-relay principle with low fault settings applied to Merz-Price feeder protection, using a 2-core pilot cable. It has been designed to operate under various fault conditions, tandem tumbler switches being arranged to operate the fault indicators on 220 volts d.c. and

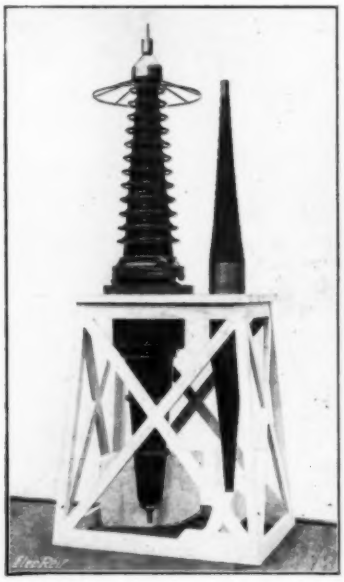


Fig. 122.—Reyrolle Giant Insulator.

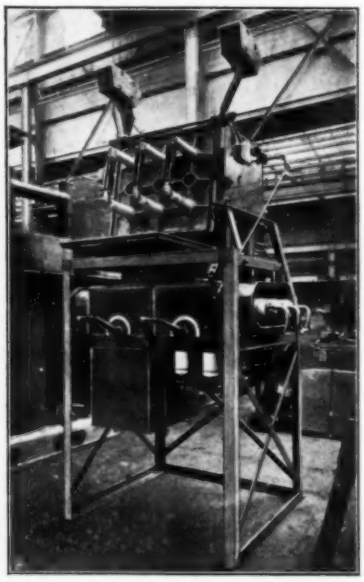


Fig. 123.—Reyrolle Oil-immersed Switch-fuse.

supply the a.c. fault current at 415 volts. The Fawssett-Parry relays, when operating, also trip the indicator representing the main oil switch, and the indicator is reset by a separate single tumbler switch. If necessary, an internal and an external fault may be put on simultaneously, demonstrating that the section with the diverter relay already operated is still sensitive under fault conditions. The model actually represents a 16-mile circuit, with a normal rating of 200 amperes, and demonstrates a fault setting of 60 amperes to earth and between phases and complete stability up to 10,000 amperes straight-through current.

The outstanding exhibit is a switch panel typical of that being used in most of the large power systems in this country for controlling the output of the generators. The

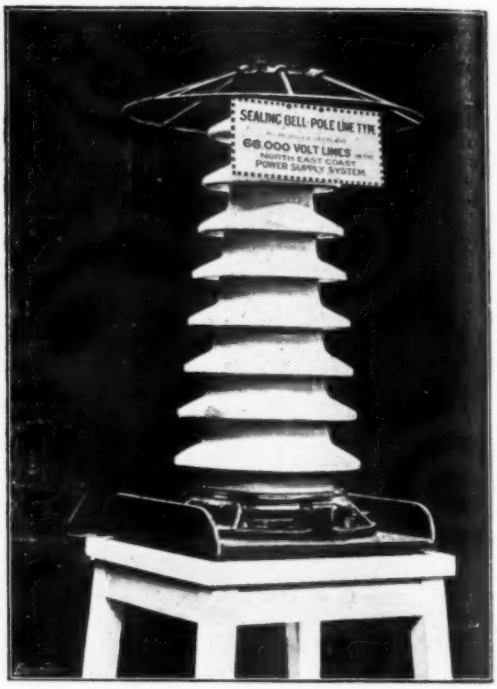


Fig. 124.—Reyrolle Pole-line Sealing Bell.

panel is the largest of its kind in the world and weighs approximately 23 tons; fig. 118 illustrates such an "M"-type, 6,500-V, 2,500-A switch on a railway truck ready for dispatch. No special masonry whatever is needed, and all conductors are totally enclosed in a metal sheath filled with an insulating compound. At the same time, all parts which may require inspection are made readily accessible by a draw-out feature, which is apparent in the other designs. Each panel is built up in a compact three-phase unit, having a separate metallic enclosure for the conductors. The main circuit breakers are immersed in oil and contained in cylindrical steel tanks. The incoming and outgoing conductors are connected through isolating switches, and a complete system of interlocking is arranged so that it is not possible to gain access to any conductor during any time that it may be "alive." There are a large number of these panels at Dalmarneck, Carville, Nechel's, and North Tees, and a large switchboard of this type is now in course of erection at the Barking station. The normal breaking capacity of the switch shown is one and a half million kVA. The main tanks normally used have been replaced by glass enclosures which enable the current-carrying parts and the details of the switch to be examined.

In order to eliminate the need for buildings wherein to house control gear and thus to place small supply schemes on an economical basis as regards overhead charges, a new type of protecting and controlling apparatus has been designed in the form of a switch fuse, as shown in fig. 123, which is designed for all voltages, and consists primarily of a fuse carried on porcelain supports fixed to the lid. The opening and closing of the lid makes and breaks the circuit at the fuse contacts. The whole of the live gear is enclosed in metal, so that the device is suitable for either indoor or outdoor use. The operation of the lid is by means of a catch and operating pole. The earthing of the cables and transformers is conveniently and safely done by first isolating

and then replacing the fuse by an earthing fitting which joins the lid to the contact that plugs into the terminal requiring to be earthed. This arrangement gives a duplicate supply, as in the event of one cable failing, the system may be quickly and safely changed over to the other, and the supply undertaking has the advantage of being able to vary the load on the cable by changing over as required.

An example of mining gear is represented in fig. 119, which shows a 3-phase, 60-amp., 660-volt flameproof gate-end switch of robust construction. This type of circuit breaker, equipped and interlocked with a flameproof metalclad mining plug, was the first circuit breaker to gain a "flameproof" certificate from the Sheffield University Mining Department.

Fig. 120 illustrates a three-phase flameproof oil circuit breaker with hand-wheel control suitable for 200, 400, and 600 amperes capacity at 660 and 3,300 volts. This switch is also suitable for heavy service in factories, shipyards, and other industrial situations. Metal-clad drawout switchgear for mining and industrial use is represented, while fig. 121 shows a 3-phase double-circuit distribution board on c.i. pedestals, consisting of two 100-amp. switch-fuse units; a 200-amp. switch-fuse is mounted on the bottom left-hand side for controlling the incoming supply.

Fig. 124 illustrates a 66,000-V oil-filled cable terminal sealing bell such as has been installed on the overhead transmission line recently set up between Dunston and Bedlington on the Newcastle-upon-Tyne Electric Supply Co.'s system for coupling single-core cables at road crossings and arranged for mounting on the terminal structure. A giant insulator is shown in fig. 122, which has been constructed for Colonial practice. It is of the 132,000-V condenser type with a corona shield, and is used as a bushing for an oil-immersed circuit breaker. The internal portion of the bushing is shown to the right, and the length of the device is about 10 ft.

Contracts Open and Closed.

Open.

(*Continued from page 1046.*)

Horsham.—June 30th. Electricity Department. 1,000 yd. l.p. triple-concentric feeder cable, .5 x .25 x .5 sq. in. area; 1,100 yd. ditto, .25 x .15 x .25 sq. in. area; 1,400 yd. of 3-core pilot cable, .003 sq. in. area. (June 20th.)

India.—August 12th. Chief Controller Indian Stores Department (Engineering Section), Simla. (1) Five passenger, three goods, and seven small service electric lifts for the Government House, New Delhi; and (2) six passenger, one goods, and four small service electric lifts for the Legislative Council Building, New Delhi. Director-General of Stores, Belvedere, Lambeth, S.E.

DELHI.—August 24th. Manufacture, delivery, and erection of passenger and goods lifts in Government buildings. (See this issue.)

Leyton.—July 18th, Urban District Council. Electrical wiring ("Henley" system) at six schools. (See this issue.)

London.—H.M. OFFICE OF WORKS.—July 15th. Electric wiring in steel conduit at Somerset House. (See this issue.)

HANWELL.—July 26th. Electric lighting installation at the Central London District School. (See this issue.)

Lowestoft.—July 14th. Mutford and Lothingland Board of Guardians. Installation of electric lighting at the Workhouse and Infirmary. (See this issue.)

New Zealand.—DUNEDIN.—August 15th. City Corporation. One synchronous condenser.

WELLINGTON.—August 26th. Department of Public Works. One 30-ton electrically-operated overhead travelling crane for Lyttelton.*.

Rumania.—TIMISOARA, TRANSYLVANIA.—July 31st. Town Electricity Works. Central switchboard.*

South Africa.—CAPE TOWN.—July 4th. Municipal Council. 1,000 a.c. meters, house service type.*
July 22nd. H.p. ironclad switchgear.*
UNION OF SOUTH AFRICA.—July 31st. High Commissioner. Automatic telephone exchanges for Parktown, Mayfair, Hatfield, and Kloof.* (June 13th.)

Sweden.—STOCKHOLM.—July 8th. Royal Medical Board (Kungliga Medicinalstyrelsen). Eighteen electric lifts for the Helsingborg Lunatic Asylum.—*Reuter's Trade Service* (Stockholm).

Walthamstow. — July 2nd. Electricity Department. Natural draught cooling tower. (June 13th.)

York.—July 1st. Electricity Department. One 6,000-kW turbo-alternator with condenser, h.p. switchgear, and an electric crane. (June 13th.)

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Closed.

Barnes.—Urban Council. Accepted:—
Sub-station plant and switchgear (£5,000).—General Electric Co., Ltd.

Belgium.—Keen international competition was experienced last week for the supply of eight lots of telephone cable to the Belgian Post and Telegraph authorities in Brussels, offers being received from Belgian, Dutch, Danish, Czecho-Slovakian, German, Austrian, and French concerns. The Compagnie Centrale d'Electricité et de Constructions, of Brussels, submitted the lowest tender for two of the lots, comprising 10 kilometres of cable. The Société Générale de Cables, of Lyons, was successful in the case of 20 kilometres of lead-covered, cotton-sheathed enamelled wire cable; the Duisburg Kabelwerk, of Duisburg, Germany, was the lowest as regarded two lots of 20 kilometres of lead-covered, paper-insulated cable; and the Nederlandsche Kabelfabriek, of Delft, as regarded two lots of 20 kilometres ditto and one lot of 40 kilometres of lead-covered, rubber-insulated cable.

The Belgian State Railway authorities in Brussels last week opened tenders for the establishment of transformer sub-stations at Jemelle and Marloie. The lowest offer was that of the Société des Etablissements Industriels Lambert, of Woluwe-Saint-Lambert, who quoted 49,700 fr. for the first and 29,850 fr. for the second. Only two firms submitted tenders for 20 kilometres of bare cable, the lowest offer (172,600 fr.) being that of the Société des Usines à Cuivre et à Zinc, of Liége.

La Société des Ateliers de Constructions Electriques de Charleroi, has secured a contract from the Belgian Post and Telegraph authorities for the supply and laying of a quantity of telephone cable in the Antwerp district. The same department has placed a contract with the Société des Anciens Usines Montefiori, of Anderlecht, for 40 tons of bronze wire, and with the Société des Usines à Cuivre et à Zinc, of Liége, for 160 tons ditto.

Only two tenders were received by the Belgian Ministry of the Colonies in Brussels for the establishment and working of a system of electricity distribution at Stanley Pool, in the Belgian Congo, the lower being that of the Société Coloniale d'Electricité, of Brussels.

Twelve Belgian concerns competed for the recent contract for the equipment of 20 transformer boxes for the Limburg Provincial Government authorities at Hasselt. The lowest offer (163,500 fr.) was that of the Société Omnium de Constructions Electriques et Appareillage, of Brussels.

Glasgow.—Corporation. Accepted:—
Digger, brick, and mason work for Dalmarnock power station extension.—John Train & Co. (£80,993).

Government Contracts.—The following Government contracts were placed during May, 1924:—

ADMIRALTY CONTRACT AND PURCHASE DEPARTMENT.

Batteries.—Chloride Electrical Storage Co., Ltd.; D.P. Battery Co., Ltd.; Hart Accumulator Co., Ltd.; Tudor Accumulator Co., Ltd.
W.t. condensers.—The Telegraph Condenser Co., Ltd.
Electric lamps.—General Electric Co., Ltd.; Metropolitan-Vickers Electrical Co., Ltd.; Siemens Bros. & Co., Ltd.; Edison Swan Electric Co., Ltd.; British Thomson-Houston Co., Ltd.
Electrodes.—Alloy Welding Processes, Ltd.
Turbo fans.—Yarrow & Co., Ltd.
Motor alternators and spares.—Crompton & Co., Ltd.
Telephone leads.—Ward & Goldstone, Ltd.

AIR MINISTRY.

Motor generators.—Crompton & Co., Ltd.
W.t. valves.—General Electric Co., Ltd.
Battery booster (Spittlegate).—Chloride Electrical Storage Co., Ltd.

POST OFFICE.

Batteries.—Cardiff Head Post Office: D.P. Battery Co., Ltd.
Manufacture, supply, drawing-in and jointing cable.—Barbados, B.W.I.: Siemens Bros. & Co., Ltd. Plymouth-Polmarkyn: Pirelli-General Cable Co., Ltd.
Power plant.—Gloucester telephone repeater station; Newport (Mon.) telephone repeater station: Newton Bros. (Derby), Ltd. Sub-contractors: D.P. Battery Co., Ltd., for batteries; Ruston & Hornsby, Ltd., for engines.
Telephone exchange equipment.—West Hartlepool; Hartlepool: Siemens Bros. & Co., Ltd. Sub-contractors: Hart Accumulator Co., Ltd., for batteries; English Electric Co., Ltd., for charging machines; Crompton & Co., Ltd., for ringing machines. Preston (Brighton); Portslade (Brighton): Siemens Bros. & Co., Ltd. Sub-contractors: Hart Accumulator Co., Ltd., for batteries; English Electric Co., Ltd., for charging machines. Rottingdean (Brighton); Cheadle Royal Asylum (Cheshire): Siemens Bros. & Co., Ltd. McFarlane, Lang & Co., Ltd. (Glasgow); Fassett & Johnson, Ltd. (E.C.); Lloyd's Packing Warehouses, Ltd. (Manchester); Cardiff Royal Infirmary: Relay Automatic Telephone Co., Ltd. Sloane: Western Electric Co., Ltd. Brighouse: General Electric Co., Ltd. Sub-contractors: D.P. Battery Co., Ltd., for batteries; Crompton & Co., Ltd., for charging machine. Hove: Siemens Bros. & Co., Ltd.
Telephone repeater station (temporary) equipment.—Leeds: Western Electric Co., Ltd.
Wireless station, transformers.—Rugby: Brush Electrical Engineering Co., Ltd.
Fire alarm apparatus.—A. C. Brown; Walters Electrical Manufacturing Co., Ltd.
Protective apparatus.—International Electric Co., Ltd.; Phœnix Telephone and Electric Works, Ltd.
Telephone apparatus.—British Insulated & Helsby Cables, Ltd.; British L. M. Ericsson Manufacturing Co., Ltd.; General Electric Co., Ltd., International Electric Co., Ltd.; Phœnix Telephone and Electric Works, Ltd.; Siemens Bros. & Co., Ltd.; Sterling Telephone and Electric Co., Ltd.; Western Electric Co., Ltd.
Wireless apparatus.—Dubilier Condenser Co., Ltd.
Cable.—British Insulated & Helsby Cables, Ltd.; Connollys (Blackley), Ltd.; Enfield Cable Works, Ltd.; General Electric Co., Ltd.; Hackbridge Cable Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Johnson & Phillips, Ltd.; Pirelli-General Cable Works, Ltd.; Siemens Bros. & Co., Ltd.; Union Cable Co., Ltd.; Western Electric Co., Ltd.
Stationary secondary cells.—Chloride Electrical Storage Co., Ltd.; Pritchett & Gold and E. P. S. Co., Ltd.
Loading coils.—Western Electric Co., Ltd.
Indicator lamps.—A. C. Cossor, Ltd.
Bronze wire.—T. Bolton & Sons, Ltd.; R. Johnson & Nephew, Ltd.; F. Smith & Co.
Enamelled wire.—International Electric Co., Ltd.

CROWN AGENTS FOR THE COLONIES.

Cable, &c.—Callender's Cable & Construction Co., Ltd.
Generator, &c.—Solus Electric Co., Ltd.
Telephone apparatus.—British L. M. Ericsson Manufacturing Co., Ltd.
Telephone materials.—Western Electric Co., Ltd.
Wireless apparatus.—Wireless station: Marconi's Wireless Telegraph Co., Ltd.

H.M. OFFICE OF WORKS.

Engineering services.—Post Office stores—motors: G. Hopkins & Sons (Clerkenwell), Ltd.

Hereford.—Town Council. Accepted:—

Refuse destructor (£9,325).—Heenan & Froude, Ltd.

Irish Free State.—DUBLIN.—Commissioners of Public Works. Accepted:—

Electrical works and supplies for the district of Dublin.—Handley and Robinson, Dublin.

London.—STEPNEY.—Electricity Supply Committee.

50 tons of pitch (£161).—Grindley & Co. (Accepted.)

Meters and time switches for 12 months. Recommended:—

Meters (2½ to 25 amps. capacity) (£3,078).—Reason Mfg. Co., Ltd. 50 and 100 amps. (£86).—Chamberlain & Hookham, Ltd.
Time switches (£600).—Venner Time Switches, Ltd.
Conduits and troughs and covers (£3,014).—Sutton & Co. (Overseal), Ltd. (Recommended.)

Coal-handling plant and ash-handling plant:—

Coal-handling Plant.	£
W. J. Jenkins & Co., Ltd. (Recommended.)	**9,753**
R. Dempster & Sons, Ltd.	11,395
Strachan & Henshaw, Ltd.	11,610
Hepburn Conveyor Co., Ltd.	11,718
Mitchell Conveyor & Transporter Co., Ltd.	12,205
Goodall, Clayton & Co., Ltd.	12,300
Babcock & Wilcox, Ltd.	12,640
Gibbons Bros., Ltd.	12,850

Ash-handling Plant.	£
W. J. Jenkins & Co., Ltd. (Recommended.)	**3,680**
Mitchell Conveyor & Transporter Co., Ltd.	3,760
G. Robson & Co.	3,858
Spencer, Ltd.	3,890
Gibbons Bros., Ltd.	3,920
R. Dempster & Sons, Ltd.	4,585
New Conveyor Co., Ltd.	5,260
E. Bennis & Co., Ltd.	5,337
Hepburn Conveyor Co., Ltd.	5,998
Underfeed Stoker Co., Ltd.	6,013
Alternative	5,540
Ride & Bell, Ltd.	6,234
Babcock & Wilcox, Ltd.	6,426
Stothert & Pitt, Ltd.	7,000

Wiring Albert Family Dwellings and Howard Buildings:—

	£
L. G. Tate & Co., Ltd. (Recommended.)	**814**
D. Watson & Co.	943
J. C. Christie	976
Electrical Installations, Ltd.	1,128
Ward Bros.	1,307

Portsmouth.—CORRECTION.—In our last issue we stated that the Hackbridge Electric Construction Co., Ltd., had received an order for, among other apparatus, four high-voltage Scott transformers, and Messrs. Johnson & Phillips, Ltd., an order for four low-voltage Scott transformers. The first-named company informs us that its order was for four Scott transformers with low-voltage secondaries, while Messrs. Johnson and Phillips are supplying four with high-voltage secondaries. The prices given in our last issue were correct.

Stirling.—Education Committee. Accepted:—

Installation of electric light at Greenhill School.—Robert Blyth & Co.

Forthcoming Events.

World Power Conference.—At the British Empire Exhibition. June 30th to July 12th. (See "Notes.")

Tramways and Light Railways Association.—Thursday, July 3rd, and Friday, July 4th. At the North British Station Hotel, Edinburgh. Annual Congress.

Institution of Civil Engineers.—Thursday, July 3rd. At the Institution, Great George Street, S.W.1. At 5 p.m. Joint meeting with other Institutions to discuss the work of the Special Committee on Tabulating the Results of Heat-Engine and Boiler Trials.

Institution of Mechanical Engineers.—Saturday, July 5th. At the Institution of Mechanical Engineers, Storey's Gate, S.W. At 11.30 a.m. Joint meeting with the Institution of Civil Engineers. "Draft Standard Test Code for Hydraulic Power Plants," drawn up by a Joint Committee of both Institutions.

Notes.

Social Events.—On June 14th the employés of the Paisley Corporation Electricity Department and their friends held their annual "outing." From Gourock the party proceeded through the Kyles of Bute to Brodick, Lamlash, and Whiting Bay. Dinner and tea were served aboard the steamer, and the weather conditions were good. Mr. W. Blair Smith (the electrical engineer) and Mrs. Smith were in the party.

The Siemens Sports Club held its annual sports on Saturday last on its ground at Park Lane, Charlton. A long programme was carried through very successfully under ideal conditions. The sports ground, which is naturally picturesque, was made festive by the addition of several marquees and the display of bunting. Over 10,000 people were present during the afternoon. The prizes were distributed by the Rt. Hon. Sir William Bull, Bart., M.P., one of the vice-presidents, and other vice-presidents present were Sir Walter R. Lawrence, Bart., G.C.I.E., G.C.V.O., C.B., and Mr. W. O. Smith. Callender's Cable Works Band greatly added to the success of the gathering.

The Austin System of Electrically-driven Ships' Auxiliaries.—Messrs. Gilbert Austin, Ltd., electrical and mechanical engineers, Cathcart, Glasgow, have developed a series system for operating ships' auxiliaries, which has the following important characteristics:—

(1) The motors cannot be overloaded.
(2) Fuses are completely abolished, and control gear is greatly simplified.
(3) The use of control resistance is reduced to a minimum.
(4) There are no fine-wire windings in the motors, so that they are extremely robust.
(5) The power wiring for a ship is greatly simplified.

The patentees are not willing to divulge technical details at the present time, but the fact that the system has been developed to a commercial stage was clearly shown at a demonstration held recently in the makers' works. At the demonstration a 50-kW generator was used to supply two Austin ship winches, and loads up to 12 tons were handled in the most convincing manner. For example, it was shown that when the load was being lowered at full speed, the controller could be thrown over and the load stopped and reversed without the slightest sign of sparking on the motor commutators, and also without overloading the generator in any way. The regenerative action of the system was also demonstrated. The application of the Austin system to steering gear was shown by manœuvring a quadrant having a maximum leverage of 20 foot-tons.

Smaller motors were used for driving reciprocating water pumps and centrifugal fans. In the former case, the chief feature of the system revealed was the fact that even when the pump was suddenly throttled while working on full load, the motor was not overloaded in any way. In the case of the centrifugal fan, it was demonstrated that perfect speed control could be easily obtained. The demonstrations have aroused great interest in shipping circles, and it is quite obvious that the new system is likely to prove a very serious rival to steam auxiliaries.

Research in India.—The Indian Universities Conference has recommended to the Government the appointment of a Central Advisory Board for scientific research.

The Loughborough Electricity Works.—With reference to our June 13th description of the plant extensions at the above-named generating station, it was explained that Mr. C. H. Wordingham, C.B.E., reported on the undertaking in 1922, and it should be clearly understood that the extensions which were subsequently made were planned and carried out by him as a result of his investigations.

Kelvin Centenary Celebrations.—To commemorate the centenary of the birth of Kelvin several interesting functions have been arranged by the Kelvin Centenary Committee for July 10th and 11th. Particulars of these have already been published in our issues of May 16th and 30th, but a further notice may be found useful by our readers.

At 4.30 on the afternoon of the 10th, at the Institution of Civil Engineers, Great George Street, Westminster, the Kelvin Medal will be presented to Dr. Elihu Thomson (U.S.A.), Sir Charles Morgan, President of the Institution, being in the chair. This will be followed immediately by the reception of written addresses from the scientific societies of the British Dominions and foreign countries. The Kelvin Oration will then be delivered (about five o'clock), by Sir J. J. Thomson. Sir Richard Glazebrook will preside at the reception of addresses and the Kelvin Oration.

In the same building there will be an exhibition of Kelvin experimental apparatus which has been collected by the committee specially for this commemoration. These exhibits will be on view from July 8th.

An important feature of the celebrations will be a banquet to take place on the evening of Friday, July 11th, at the Connaught Rooms, Great Queen Street, London. The Rt. Hon. Earl Balfour, K.G., O.M., F.R.S., will preside. Many distinguished scientists and engineers, among them delegates from the Societies of Great Britain and the Dominions, as well as the continent of Europe and the United States, have already indicated their intention to be present. Tickets for the dinner, the price of which is £2 2s. inclusive of wines and cigars, will be issued in order of priority of application, the seating accommodation being limited. Those who wish to attend the banquet should send in their application for tickets, with their names and addresses, and the names of their proposed guests (clearly indicating titles and decorations, if any), to Mr. D. N. Dunlop, Hon. Secretary of the Kelvin Centenary Committee, 61 and 62, Lincoln's Inn Fields, London, W.C.2, to whom crossed cheques for the amount of the tickets should be made payable.

The World Power Conference.—On Monday next the World Power Conference will be opened at the British Empire Exhibition, and will continue in session until July 12th. Particulars were given in our issue of May 16th, p. 789. The organising director is Mr. D. N. Dunlop, and full information can be obtained from the secretary, World Power Conference, 36, Kingsway, London, W.C.2.

At 3.30 p.m. on Monday an official reception will be held, under the presidency of Lord Derby, and at 7.30 p.m. the official banquet will take place at the Queen's Hall, Langham Place, London.

On Tuesday, from 10.15 a.m. to 12.45 p.m., and from 2.30 to 5 p.m., the subject of "Power Resources" will be discussed, and at the same hours on the following day the "Economic Aspect of Power Resources" will be under discussion, the whole Conference sitting in one hall.

Afterwards the members will divide into three sections, sitting simultaneously in different halls, the subjects dealt with being as follows:—

Thursday, July 3rd: Economic Aspect of Power Resources; Steam Generation; Preparation of Fuels; Water-power Production.

Friday, July 4th: Water-power Production; Steam Utilisation; Preparation of Fuels; Illumination; Power from other Sources, and Mechanical Transmission of Power.

On Saturday and Sunday no meetings will be held.

Monday, July 7th: Power Transmission and Distribution; Internal Combustion Engines; Gas and Fuel Section.

Tuesday, July 8th: Power Transmission and Distribution; Gas and Fuel Section; Power in Industry and Domestic Use; Power for Road and Air Transport; Research.

Wednesday, July 9th: Power in Industry and Domestic Use; Power in Electrochemistry and Electrometallurgy; Industrial Welfare; Power for Rail Transport; Publicity.

Thursday, July 10th: Power for Rail Transport; Power for Water Transport; Education, Technical, and Commercial; Standardisation. (On this day the Kelvin Centenary Celebrations will commence, at 4.30 p.m.)

Friday, July 11th: Permanent Organisation and General Meeting; British Empire Resources.

This is the last day of the Conference Sessions.

The special programme of the Institution of Electrical Engineers for oversea electrical engineers commences on Thursday, July 10th, with a reception at the Institution Building at 12.30 p.m., and an address of welcome by the president, Dr. Alexander Russell, F.R.S., followed by luncheon at the Hotel Cecil at 1.15. As mentioned above, the Kelvin celebrations, which are detailed elsewhere, commence at 4.30 p.m.

On Friday, July 11th, at 10 a.m., there will be a visit by motor coach to the British Empire Exhibition, and at 7 p.m. the Kelvin Centenary Banquet will be held, Lord Balfour, O.M., in the chair.

Current Loading of Cables.—The British Electrical and Allied Industries Research Association has published a booklet (Ref. F/T 14; price 1s. 6d.) giving in a concise form tables showing the permissible current loading of British standard impregnated paper-insulated electric cables (B.s.s. No. 7—1922), with explanatory notes. This 19-page booklet should prove very useful, the data given therein having been abstracted from the B.E.A.I.R.A. report F/T 12.

The Industrial Welfare Society.—The fifth annual lecture conference of the Society is to be held at Balliol College, Oxford, from September 12th to 17th. Among those whose names appear in the list of speakers are Mr. A. P. M. Fleming, M.I.E.E., Sir James Cantlie, K.B.E., Mr. John Lee, C.B.E., M.A., and Miss A. Maude Royden.

Appointments Vacant.—Plumber-jointer for the Paisley Corporation Electricity Department. Technical and commercial assistant, mains assistant, and junior mains assistant for the Ayrshire Electricity Board. Wireless engineer and assistant electrical engineer (£460+) for the Government of Hong Kong (telephones and telegraphs). (See our advertisement pages to-day.)

Institution Notes.

Institution of Electrical Engineers.—VISIT OF OVERSEA ELECTRICAL ENGINEERS.—Members of the Institution who wish to be present at the luncheon to be given to the oversea delegates at the Hotel Cecil on Thursday, July 10th, are reminded that they should make early application for tickets, as the lists will be closed within the next few days.

Institution of Public Lighting Engineers and Superintendents.—The first annual meeting of the Institution is to be held in Glasgow on September 16th and 17th. On the 16th the members and delegates will be officially received by the City Corporation and entertained to luncheon in the City Chambers. On the same day the President (Mr. Langlands, J.P.) will deliver his presidential address. Papers on important subjects will be read by the following:—Mr. T. Haydn Harrison, M.I.E.E., subject to be announced later; Mr. E. J. Stewart, M.A., B.Sc., "Street Lighting and Visibility"; and Mr. R. B. Mitchell, M.I.E.E., "Electric Mains for Street Lighting." On September 18th it is hoped to arrange a visit to Edinburgh.

The Institute of Cost and Works Accountants.—The fifth annual dinner of this Institute is to take place on Thursday, July 24th, at 7 for 7.30 p.m., Viscount Leverhulme presiding. The costing conference will be held on the following day. At the morning session the subject will be "Administration and Selling Costs, their Nature and Distribution." At the afternoon session "The Function of Costing in Industrial Relations" will be discussed. The British Empire Exhibition will be visited on Saturday, July 26th.

Our Personal Column.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Mr. T. W. ELLIS, consulting engineer, has removed to 70, Victoria Street, London, S.W.1.

Mr. P. R. BLAKE, formerly manager of the Gravesend and Northfleet Electric Tramways, Ltd., has been appointed manager of the omnibus section of the Scottish General Transport Co., Ltd.

Mr. ROGER T. SMITH, having retired from the position of electrical engineer to the Great Western Railway, has joined the firm of Messrs. J. S. & W. E. Highfield, consulting engineers. Mr. J. S. Highfield was joined by his brother, Mr. W. E. Highfield, in 1920. The partners now are Mr. J. S. Highfield, Mr. W. E. Highfield, and Mr. Roger T. Smith. The firm will, in future, be known as Highfield & Roger Smith, consulting engineers, 36, Victoria Street, S.W.1.

The *Financial Times* states that Mr. T. S. NETTLEFOLD, general manager of the Hume Pipe Co. of Australia and New Zealand, has arrived in London in connection with the development of the Hume patents for concrete pipes.

It is reported in the daily Press that among the 25 Canadian delegates who sailed from Quebec on June 19th to attend the World Power Conference was Sir ADAM BECK, chairman of the Ontario Hydro-Electric Power Commission.

Mr. A. HENDERSON, M.I.E.E., has resigned his position as joint managing director of Messrs. J. A. Kinnaird & Co., Ltd., Glasgow, to take up an appointment as superintendent electrical engineer to the Canadian Pacific Steamships, Ltd., at its head office in London. Mr. Henderson has been connected with marine electrical work for many years. He is a member of the I.E.E. Ships' Electrical Equipment Committee. Before joining Messrs. Kinnaird in 1919 he was with Messrs. John Brown & Co., Ltd., Clydebank, and Scotts' Shipbuilding & Engineering Co., Ltd., Greenock. We understand that developments in the electrical equipment of the ships of the Canadian Pacific Co. may be looked for.

Last Friday evening Mr. L. C. F. BELLAMY, the tramway manager at St. Helens, was presented with a case of cutlery on his retirement prior to sailing for Hong Kong.

Stirling Town Council has increased the salary of Mr. WILLIAM R. MURRAY, burgh electrical engineer, by £25 to £425 per annum.

Consequent on the promotion of Mr. F. H. WYNNE to be Deputy-Chief Inspector of Mines, Mr. J. R. FELTON, O.B.E., has been appointed Divisional Inspector of Mines for the York and North Midland Division.

At the Convention of the District Engineer Representatives attached to the Feed Water Specialists Company, held in Liverpool from June 10th to 13th, the annual dinner took the form of a send-off to the manager, Mr. H. W. BANNISTER, who is going to the United States to gather data on steam raising economies.

Mr. H. J. KENNEDY was recently presented by the staff of the Electrical Development Association at Wembley with a case of pipes and accessories upon his retirement from the position of assistant manager of the E.D.A. Exhibition Section.

In our issue of June 13th we stated that the salary of Mr. F. H. EDWARDS, the engineer and manager of the Dartford Urban District Council's electricity works, was to be increased from £600 to £750 by annual increments of £50. Mr. Edwards informs us that this is incorrect, the increase to £750 is being made forthwith.

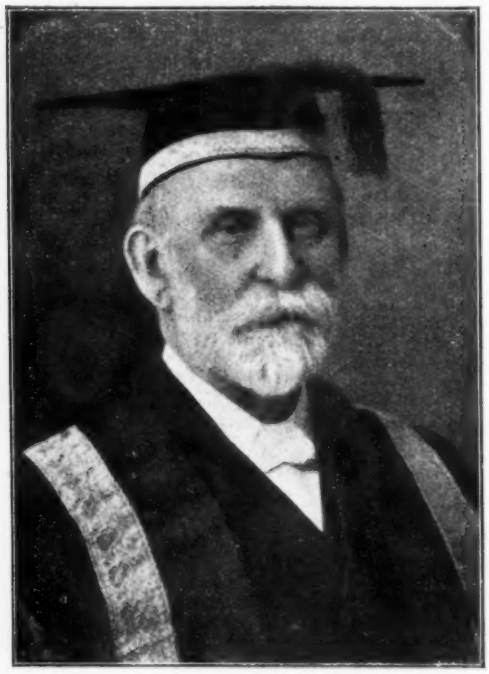
Mr. FRANK H. GLOVER, who has been appointed general manager of the St. Helens tramways, has been presented with a suit case by the Corporation tramway employés at Reading.

Llandrindod Wells Urban Council is recommended to increase the salary of the resident electrical engineer, Mr. C. C. WILDE, by two annual increments of £50, to £400 per annum.

Mr. CLAUDE M. TOPLIS, who has for the past 14 years been chief engineer to Messrs. Stothert & Pitt, Ltd., Bath, has resigned his position and taken a partnership in the Bedford Engineering Co., Bedford, in which Major E. G. Fiegehen is the remaining partner.

Obituary.—DR. R. MULLINEUX WALMSLEY.—The death of Dr. Robert Mullineux Walmsley, which was recorded in our last issue, as the result of a street accident, has removed from active service in our midst one who has for very many years occupied a position of great prominence in electrical, optical, and other technical educational affairs. To hosts of electrical men he has become personally known through his supervision of their instruction and training at the Northampton Polytechnic Institute in Clerkenwell, of which he was appointed principal from the beginning in 1895, a post which he held right up to the day of his death. Dr. Walmsley

was born and educated in Liverpool. He took his degree B.Sc. London in 1882, and his D.Sc. London (Electricity and Magnetism) in 1886. He was for a time a master at the Royal Naval School, New Cross, and an assistant to the late Professors Ayrton and Perry at the Horological Institute, Clerkenwell. He worked under Prof. Ayrton, and, later, Professor Silvanus P. Thompson, as Senior Demonstrator in Electrical Engineering and Applied Physics at the Finsbury Technical College, from its opening in 1883, until he was appointed principal of the new Technical College at Karachi in 1886. During his stay in India he advised the Government of Bombay on matters connected with the development of technical education in that Presidency. Upon his return to England he was appointed Senior Mathematical Lecturer and Demonstrator at the City and Guilds College in London, and later he became Professor of Electrical Engineering and Applied Physics at the Heriot-Watt College, Edinburgh. He left there in 1895 to come to Clerkenwell as stated. In addition to his



THE LATE DR. R. MULLINEUX WALMSLEY.

work at the Northampton Polytechnic Institute, where many thousands of students came under his care and where the annual prize distribution and conversazione nights brought together very large audiences to hear speeches from some of the most eminent men of the time, including, as we well remember, Lord Kelvin (Lady Kelvin accompanying him to distribute the prizes), Lord Herschell, and others of great distinction, Dr. Walmsley was keenly interested in all matters concerning technical education. He served on numerous committees in this connection. The development of technical optics in England was a subject in which he took a very keen interest. His contentions in this regard were fully justified during the European war, and it was a matter of satisfaction to him and those associated with him that the Northampton Institute was able to turn its Optical Department to good account in the training of girls as lens grinders. He was also one of the first to realise the vital necessity of giving disabled soldiers a chance to make a fresh start in life when their former means of occupation was no longer possible. He trained at the Institute many men who had lost an arm or leg, so that they were able to follow such a calling as that of sub-station attendant. No reference to the deceased gentleman's career can be complete without mention of his books, especially "Electricity in the Service of Man," a very popular work which, since it was first brought out, has passed through many editions (a new and very large edition having only recently appeared). Dr. Walmsley was a Fellow of the Royal Society of Edinburgh and a member of the Institution of Electrical Engineers.

An inquest was held on Wednesday last week, and the medical evidence showed that death was due to fracture of the skull. It appeared that Dr. Walmsley became confused by the traffic, but the evidence showed that he was in a perfect state of health prior to the accident and never complained of faintness or giddiness. The motor was proceeding at from eight to nine miles per hour and stopped dead after striking him; the body was not run over. The verdict returned was "Accidental Death." The funeral took place on Thursday, June 19th, a service being held at St. Luke's Church, West Holloway, followed by the Committal Service at Golder's Green Crematorium.

MR. T. COMMERFORD MARTIN.—We regret to record the death of Mr. T. Commerford Martin, which occurred at Pittsfield, Mass., on May 18th at the age of 67 years. The *Electrical World* for May 24th contains a full account of his career. Mr. Martin had been in poor health for several years, but his death followed an attack of pneumonia. He was born in London, but went to America as a very young man, and from 1877 to 1879 was associated with Thomas A. Edison in laboratory work and pioneer electrical development. In 1883 he became editor of the *Electrical World*, a position which he filled for seven years, when he resigned and took the editorship of the *Electrical Engineer*. In 1899, when the *Electrical World* had passed under the control of the McGraw Publishing Co., which also purchased the *Electrical Engineer* and consolidated the two papers, he again became editor of the former, being associated in that capacity with the late W. D. Weaver. He retained this post until 1909. News of his death was received just as the finishing touches were being put to the arrangements of the Atlantic City Convention of the National Electric Light Association, for which he was Executive Secretary from 1910 to 1919. His death imparted a note of sorrow to the proceedings, and the president of the Association sent a telegram of condolence to his widow. Mr. Martin was a writer of the highest class in technical literature, and our contemporary mentions his ability as a public speaker, he being known on the lecture platform in England and France as well as in the States. He was prominently connected with many electrical and other engineering societies, clubs, and so forth, and was a past president of the American Institute of Electrical Engineers. At the time of his death he was secretary of the New York Electrical Society. During the war and subsequently he lent valuable aid to many movements for the public benefit in America, France, and Italy.

New Companies Registered.

Central Radio Stores, Ltd. (198,587).—Private company. Registered June 12th. Capital, £1,000 in £1 shares. To carry on business as indicated by the title. The first directors are:—H. C. W. Foster, Hornby Castle, Hornby, Lancs., gent.; J. Cookson, 66, Albert Road, Blackpool, wireless engineer. Remuneration as fixed by the company. Solicitor: C. E. Warren, 61, Albion Street, Leeds. Registered office: 1b, Bolton Street, South Shore, Blackpool.

Watford Radio Supplies, Ltd. (198,632).—Private company. Registered June 13th. Capital, £500 in £1 shares. To carry on the business of electricians, mechanical engineers, and manufacturers and workers of and dealers in electricity, motive power and light, and wireless telegraphy and telephony; manufacturers of and dealers in automobiles, motor-cars and cycles, garage proprietors, &c. The subscribers (each with one share) are:—G. H. Bateman, 1, Gonville Avenue, Croxley Green, Watford, engineer; D. C. Poole, 297, New Road, Croxley Green, Watford, engineer. G. H. Bateman signs documents as director. Secretary: G. H. Bateman. Solicitors: Penman & Brown, 31, High Street, Watford.

London and Provincial Deep Level Railway Co., Ltd. (198,675).—Private company. Registered June 17th. Capital, £200 in £1 shares. To carry on business as indicated by the title. The subscribers (each with one share) are:—Edgar Joseph W. Richards, 115, Worple Road, Wimbledon, S.W.20, consulting engineer; H. Hoyne-Fox, Hill's Hotel, Princes Square, W.2, and 4, Palmeira Avenue Mansions, Hove, engineer and architect. The first directors are:—Edgar Joseph W. Richards, Edward John W. Richards, T. H. Oswald, and H. Hoyne-Fox (life directors). Registered office: 10, Long Acre, W.C.2.

Wood & Co. (Ipswich), Ltd. (198,653).—Private company. Registered June 18th. Capital, £2,500 in 2,350 ordinary shares of £1 each and 3,000 founders' shares of 1s. each. To acquire the business carried on at Ipswich as "Wood & Co.," and to carry on the business of electrical engineers and contractors, suppliers of electricity, carriers of passengers and goods, manufacturers of, and dealers in electrical and other apparatus, &c. The first directors are:—H. M. Brown, 340, Green Lanes, Finsbury Park, N.; T. P. Wood, 212, Felixstowe Road, Ipswich, electrical engineer; W. J. M. Oliphant, New Estate, Shotley Gate, Suffolk, electrical engineer. The two first-named are joint managing directors. Secretary: H. M. Brown. Solicitor: H. Chandler, 17, Fleet Street, E.C. Registered office: 2, Northgate Street, Ipswich.

Britain's Best Crystal, Ltd. (198,666).—Private company. Registered June 17th. Capital, £100 in £1 shares. To carry on the business of electricians, manufacturers of electrical apparatus, &c. The permanent directors are:—J. M. Ortega, Regent House, Kingsway, W.C. (director, Charleston & Co., Ltd.); Mrs. F. M. Ortega, 4, "Dagworth," Ferry Lane, Shepperton (director, Charleston & Co., Ltd.). Registered office: Regent House, Kingsway, W.C.

Regent Radiophone Co., Ltd. (198,657).—Private company. Registered June 16th. Capital, £1,000 in £1 shares. To acquire the business of manufacturers of, agents for, and dealers in instruments, apparatus, accessories, and materials of all kinds for use in connection with radio or wireless telegraphy and telephony now carried on by G. T. Crawley and G. R. Hodgkison at 59, Hounds Gate, Nottingham, as the "Regent Radiophone Co." The permanent directors are:—O. Gatcher, "The Cottage," Bulcote, Notts.; G. T. Crawley, 6, Gilead Street, Bulwell, Notts.; G. R. Hodgkison, 8, Austen Avenue, Nottingham. Qualification, 100 ordinary shares. Remuneration as fixed by the company. Solicitor: H. T. Masser, 4, St. Peter's Church Walk, Nottingham. Registered office: 4, St. Peter's Church Walk, Nottingham.

Wantage Electric Supply Co., Ltd. (198,584).—Private company. Registered June 12th. Capital, £6,000 in 600 6 per cent. cumulative preference shares of £5 each and 3,000 ordinary shares of £1 each. To carry on the business of an electric lighting and power company in all its branches. The subscribers (each with one share) are:—J. H. Edwards, "Woodside," Cronham, Glos., electrical engineer; L. Parkinson, "Park View," Ebley, Glos., incorporated secretary. J. H. Edwards is the first managing director. Solicitor: C. E. Edwards, 16, St. Andrew's Crescent, Cardiff. Registered office: Electricity Offices, Cainscross, Stroud, Glos.

A. C. Hamilton, Ltd. (198,586).—Private company. Registered June 12th. Capital, £500 in £1 shares (253 10 per cent. non-cumulative preference and 247 ordinary). To adopt an agreement with C. H. Withers, and to carry on the business of electrical and general engineers and contractors, suppliers of electricity, manufacturers of electric, galvanic, wireless, and other apparatus, &c. The permanent directors are:—C. H. Withers, 4, Tennis Road, Hove, factor (managing director); E. C. Colman, 89, Avenue de Corlenbergh, Brussels. Qualification of permanent directors, 100 shares. Solicitor: C. S. Jupp, 3, Gray's Inn Place, Gray's Inn, W.C. Registered office: 12, Archer Street, Piccadilly Circus, W.

Albany Accumulators, Ltd. (198,683).—Private company. Registered June 18th. Capital, £1,000 in £1 shares. To carry on the business of manufacturers and merchants of and agents for wireless apparatus of all kinds; motor and electrical accessory manufacturers, &c. The first directors are:—V. V. Pass, 10, Hillfield Road, West Hampstead, N.W.6, accumulator factor; N. J. Hay, 6, Causton Road, Highgate, N.6, accumulator specialist. Qualification, 1 share. Registered office: 20, Albany Street, N.W.1.

Official Returns of Electrical Companies.

National Signs, Ltd.—Satisfaction to the extent of £275 on May 30th, 1924, of mortgage dated August 29th, 1923, securing £600.

Power Progress, Ltd.—J. T. Matthews, of St. Michael's Chambers, High Street, Southampton, was appointed receiver and manager on May 30th, 1924, under powers contained in debentures dated March 17th, 1921.

Newcastle and District Electric Lighting Co., Ltd. (28,025.)—Return dated March 28th, 1924. Capital, £300,000 in £10 shares. All shares taken up. £297,500 paid. £2,500 in arrears of calls. Mortgages and charges, £316,860.

City of London Electric Lighting Co., Ltd. (34,406).—Return dated April 9th, 1924. Capital, £2,000,000 in 400,000 6 per cent. first preference, £300,000 8 per cent. second preference, £800,000 ordinary and £500,000 unclassified shares of £1 each. 400,000 6 per cent. first preference, 300,000 8 per cent. second preference, and 800,000 ordinary shares taken up. £1,500,000 paid. Mortgages and charges, £900,000.

Costa Rica Electric Light and Traction Co., Ltd. (56,447).—Return dated April 2nd, 1924. Capital, £130,000 in £1 shares. All shares taken up. £7 paid. £129,993 considered as paid. Mortgages and charges, £285,250.

Melbourne Electric Supply Co., Ltd. (63,334).—Return dated January 2nd, 1924. Capital, £1,750,000 in 150,000 preference shares of £5 each and £1,000,000 consolidated ordinary stock. 100,000 preference shares and £800,000 consolidated ordinary stock taken up. £1,286,445 paid on 100,000 preference shares and £786,445 consolidated ordinary stock. £14,155 considered as paid on £14,155 consolidated ordinary stock. Mortgages and charges, £1,241,521.

Pirelli, Ltd. (103,068).—Return dated November 5th, 1923. Capital, £250,000 in £1 shares. 200,000 shares taken up. £200,000 paid. Mortgages and charges, nil.

New Welding Co. (Southern), Ltd.—Issue on May 26th, 1924, of £100 debentures, part of a series already registered.

Godfrey Salmon, Ltd.—Debenture dated May 27th, 1924, to secure £500 charged on the company's property, present and future, including uncalled capital. Holder: A. J. Saunders, 9, The Rise, Palmer's Green, N.13.

Cryselco, Ltd.—Debenture charged on the company's undertaking and property, present and future, including uncalled capital (subject to first mortgage debentures already registered), dated June 2nd, 1924, to secure all sums and losses, not exceeding £10,000, for which the holders may become liable under certain guarantees relating to a certain contract and in order to give effect to which they have deposited certain securities with the bankers. Holders: Capt. E. G. S. Churchill, 7, Park Place, St. James's, S.W., and others.

Upton and Garrett, Ltd.—Debenture dated May 29th, 1924, to secure £40, charged on the company's undertaking, present and future, including uncalled capital. Holder: R. S. Smallman, 8, Queen Street, E.C.4.

Kent House Engineering Co., Ltd.—Issue on June 6th, 1924, of £250 debentures, part of a series already registered.

Henry Joseph & Co., Ltd.—Issue on May 16th, 1924, of £250 debentures, part of a series already registered.

Electrical Contracts and Maintenance Co., Ltd.—Debenture dated May 30th, 1924, to secure £910, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: G. O. White, 12, John Street, Bedford Row, W.C.

Dynelex, Ltd.—Debenture dated June 6th, 1924, to secure £1,200, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: F. V. Ellis, 19, Hetley Road, Shepherd's Bush, W.

City Notes.

Whitehall Electric Investments, Ltd.

The income for 1923 was £611,801 gross and £370,165 net, as compared with £538,764 and £318,786 respectively in 1922. A dividend of 2½ per cent. on the ordinary shares (as against 2 per cent.) is recommended, and a balance of £132,665 is to be utilised for the reduction of discount on debenture stock. During the year the company has acquired the electric light, power and tramway systems of Valparaiso and also the hydro-electric undertaking at La Florida, near Santiago.

At the annual meeting, which was held on June 19th, the Chairman (the Hon. Clive Pearson) said that the gross income was approximately £75,000 higher. This included revenue from new investments, but the income from the original undertakings was fully maintained. Dealing with the individual companies, the Chairman said that the new hydro-electric plant of the Cia Chilena de Electricidad, at Maitenes, continued to operate satisfactorily. The auxiliary peak load plant was available for service, and this brought the total capacity up to 25,000 kW. The extensions and improvements to the light and power system, including h.p. transmission lines to Valparaiso and other places, receiving stations at Santiago, Las Vegas, and Valparaiso, and various sub-stations and l.p. distribution systems, were practically completed. This company had also extended its field of operations by the acquisition of the San Bernardo Railway Co., which operated 18 km. of electric railway, and supplied electricity in San Bernardo. Considerable increases in the load were expected from the extended electrification of the Chilean State Railways. The receipts from the Santiago tramways continued to be poor, but authority for increased fares was under consideration by Congress.

The Cia de Electricidad de Valparaiso, which had been acquired, served the principal port of Chile. The property included a 4,000-kW hydro-electric plant and a steam station of the same capacity. The scope of this company would be extended considerably. The Cia Hidro-Electrica owned the 15,000-kW power station of La Florida, which had been rented to and operated by the Cia Chilena for some years. The Mexican companies had been adversely affected by the political and industrial conditions. The Tampico Co. had experienced a series of strikes, and the control had been taken over by the workers for two months. The properties were returned to the company in February. It was hoped that the country would settle down after the presidential election, which would take place shortly; once normal conditions were restored, a general improvement in commerce and industry would follow. The recent extensions of the Tampico and Puebla companies would enable these to take full advantage of the improvement.

With regard to finance, Mr. Pearson said that the new purchases had been met temporarily by advances. Steps were to be taken to capitalise these on a permanent basis by the creation and issue of £1,000,000 of additional preference shares, and a further £1,000,000 of debenture stock. The prospectus is referred to on p. 1056.

United Electric Tramways of Montevideo, Ltd.

The annual meeting of this company was held on June 17th, under the chairmanship of Sir George A. Touche, Bart. In presenting the report and accounts, which were reviewed in our issue of June 13th (p. 976), the chairman said that the principal reason for the higher operating expenses was the increase in wages granted to the employés by the Municipality without any compensating increase in fares. The company had itself promised increased wages if higher fares were permitted, and at the request of the Court the compulsory increases were being paid and the company was reserving its claim against the Municipality. Despite the increase in traffic the company had derived no additional benefit. The tramways had been an important factor in the development of the city, but the shareholders who had furnished the money were being treated unfairly. The system could not be kept up-to-date or extended without additional capital, which there was little encouragement to raise at present. In consequence of the treatment which the company had received, it had been able to pay only one dividend on the ordinary shares in the past nine years; the average return on the ordinary shares for the twenty years of the company's existence was 2.8 per cent. It was regrettable that a purely business question such as this matter of increased tariffs should have been dragged into the arena of Uruguayan politics.

Oriental Telephone & Electric Co., Ltd.

The report for 1923 shows that the net revenue amounted to £44,996; to this is added £9,274 brought forward, making £54,270. Of this amount interim dividends absorbed £13,201; a final dividend of 3½ per cent. on the old preference shares requires £1,625; a final dividend of 6 per cent., free of tax, on the old ordinary shares (making 10 per cent., free of tax, for the year) requires £17,364; a dividend at the rate of 7 per cent. per annum on the new preference shares will absorb £1,515; and a dividend at the rate of 10 per cent., free of tax, on the new ordinary shares will require £2,177. £2,000 is transferred to the staff pension fund, and a balance of £16,388 carried forward. During the year the capital was increased to £900,000 by the issue of 300,000 new £1 ordinary shares, and 200,000 £1 cumulative preference shares, the rate of dividend on the previously-existing preference shares being increased at the same time to 7 per cent. The transfers of the company's undertakings at Madras, and at Rangoon and Moulmein, have been completed. The former undertaking was handed over to the Madras Telephone Co., Ltd., in consideration of £110,000 in shares of that company. The Rangoon and Moulmein undertaking was transferred to the Rangoon Telephone Co., Ltd., in consideration of the payment of £145,000 in shares. The net profits of the Singapore and Rangoon branches have fully come up to expectation. The extensive works at Calcutta and Bombay have practically been completed. The Bombay system is automatic and the Calcutta system is of the common battery type; the extensions will enable the companies to provide ample services for many years to come. The results from the Bombay and Bengal companies are considered satisfactory in view of the circumstances in which they worked during the year. The China company paid a 20 per cent., free of tax, dividend. Meeting: July 1st.

Kalgoorlie Electric Power and Lighting Corporation, Ltd.

The directors announce that the 5 per cent. interest on the income debenture stock, recommended in the report, cannot be paid at present owing to the action of one of the trustees who requires to know the value of the different assets in order that he may satisfy himself with regard to the amount of depreciation which can be written off. The directors also state that the other trustee dissociates himself from this action, and that they are prepared to justify their position in the courts.

Anglo-Portuguese Telephone Co., Ltd.

Viscount St. Davids presided at the annual meeting on June 16th, and in presenting the report and accounts (*vide* Electrical Review, June 13th, p. 977), said that the reduction of the loss from £16,000 to £7,000 was not unfavourable, in the circumstances. The exchange continued to fall, and while he thought that a small profit might be made in the current year, it would certainly be insufficient to permit of the payment of a dividend. The full effects of the increased tariffs would not be felt until 1925; so far the benefits of all increases had been nullified by the fall in exchange. A commission had been appointed to consider these matters, and the company had asked for power to automatically increase the rates with the fall of the exchange, and also to substitute a message rate in the place of the present flat rate. The company's relations with the Portuguese Government were most satisfactory.

British Broadcasting Co., Ltd.

The annual meeting of the company was held on June 19th, when Lord Gainford took the chair. The report for the year ended March 31st last, which was presented, showed that the receipts from licence fees were £176,934. The sum receivable from tariffs was £106,957, but of this amount £81,579 was allocated to the period subsequent to the end of the year, leaving £25,378 to be added to the licence fees. These, together with sundry other receipts, rendered available a total of £206,974. The expenditure on account of the provision of programmes, operating, depreciation, &c., amounted to £197,562, and £5,600 was reserved for taxation, leaving a profit of £3,812. The dividend is paid on the 7½ per cent. ordinary shares, and £723 is carried forward.

Proposals were put forward at the meeting for a rearrangement with regard to licence fees, tariffs, &c.; these, which are dealt with in our "Radio Notes," were unanimously approved, and the report and accounts were adopted.

J. G. White and Co., Ltd.

The difficult conditions met with in the past year enabled the company to earn only £123, and with the amount brought forward the total available is £1,367, which it is proposed to carry forward. The company's subsidiary, the Consolidated Construction Co., has made serious losses on fixed priced contracts, and it is proposed to write off the value of the whole of its share capital against the investment reserve. It is anticipated that further provision will have to be made against amounts set down as advances to subsidiary companies.

Prospectus.

Whitehall Electric Investments, Ltd.—The list of applications was to close on or before yesterday, Thursday, for £1,000,000 six per cent. first mortgage debenture stock offered for sale at 94 per cent., and 1,000,000 7½ per cent. cum. preference shares of £1 each at par. It is explained in the prospectus that in August, 1923, the electric power, light and tramway system of Valparaiso and the hydro-electric power station at La Florida near Santiago were acquired by the purchase of the whole of the debenture and share capital of two Chilean companies. The object of the present issue is to provide funds for these and other purchases, the instalments already due having been met by advances from the company's bankers, and for extensions and betterments of the Valparaiso property. As we go to press we learn that the lists were closed on Tuesday, for London, owing to heavy over-subscription.

German Electrical Companies.

The *German Cable Works Company*, of Berlin-Lichtenberg, states that the undertaking has so far been well employed in the current year, and orders are on hand for some months ahead. The net profit for 1923 is brought forward.

The Continental Company for Electrical Undertakings, of Nuremburg, which was the former trust company of the Schuckert company of the same town, and is now the owner of supply works, and has participations in other works, proposes to transfer last year's profits to the current year's accounts.

The Company for Electrical Undertakings, of Berlin, whose net profits have been carried forward to 1924, reports that 1923 was a specially difficult year for the subsidiary companies owning tramways and electricity works. The conditions, however, improved after the stabilisation of the mark. Obstacles were encountered in the execution of works of extension owing to the gold basis of the prices of materials that was introduced prematurely, whereas the tariffs only yielded stable returns about the end of the year.

The Bergmann Electricity Works Company, reporting on 1923, states that the costs of production exceeded the parity of the world's market, and this circumstance, together with the protective duties adopted by various European countries, hampered the company's foreign trade, although the export sales were maintained on the level of 1922, particularly to oversea countries. The net profits in 1923 have been carried forward. During the past few weeks the receipt of orders has largely increased, so that extended manufacturing has taken place in most departments.

The report of the *Felten and Guilleaume Carlswerk Gesellschaft*, of Mulheim, Cologne, for last year, shows a net profit of 6,801 billions of marks, as compared with 955,587,890 marks in 1922, when a dividend of 400 per cent. was paid. As mentioned in our last issue, it has been decided to carry the whole of the available net profits forward, no dividend being declared. Owing to the difficulties arising from the occupation it was impossible fully to employ the increased number of workmen brought over from 1922, while foreign competition also exercised a prejudicial effect. An order was received for a multiple-core telephone cable for the extension of communication between Germany and Switzerland, which was laid through Lake Constance in the current year with satisfactory results. After the cessation of passive resistance it was possible to obtain orders both for home account and for export, so that the degree of activity at present is favourable.

French Companies.

The *Chemin de Fer Métropolitain*, of Paris, earned net profits of 12,250,000 fr. in 1923, as compared with 12,586,000 fr. in the previous year, and the dividend is increased from 30 fr. per share in 1922 to 31 fr. for last year.

The *Compagnie des Etablissements Devilaine et Rouge Omnium d'Installations Electriques* records net profits and balance forward amounting to 782,000 fr. for 1923. It is proposed to pay a dividend at the rate of 12 per cent. on the old shares and 6 per cent. on the new capital.

The *Société des Forges et Ateliers de Constructions Electriques de Jeumont* has declared a dividend at the rate of 25 fr. per share out of net profits of 11,099,000 fr. in 1923, which were derived partly from manufacturing and partly from investments in manufacturing and supply undertakings.

The *Société d'Electro-Chimie, d'Electro-Metallurgie et des Aciéries Electriques d'Ugine* records net profits of 4,880,000 fr. for 1923, as contrasted with 3,330,000 fr. in the preceding year. The directors recommend a dividend at the rate of 7 per cent. or 35 fr. per share, as against 5 per cent. or 25 fr. in 1922.

The *Compagnie Electro-Mécanique* reports a gross profit of 6,601,000 fr. for 1923 and a net profit of 285,000 fr., which has been carried forward. It is explained that the profits declined owing to the falling prices in recent years, customers having a tendency to subordinate quality to cheapness. A perceptible improvement has taken place in recent months with some advance in prices, but it is considered still necessary to make efforts to obtain higher prices. The three works at Bourget, Lyons and Havre are well provided with orders, the total of which corresponds to 145,000,000 fr.

The *Compagnie Générale de Télégraphie Sans Fil*, of Paris, reporting on the past year, gives a review of the situation of the various radio companies in which it is interested in France, Belgium, Italy, and other countries, and confirms the conclusion of an agreement with the Russian Electrotechnical Bureau with regard to technical co-operation and deliveries, which agreement is being carried out in a normal manner. The report also refers to the company's participation in radio installations in Argentina, Brazil, and Chile, and to its activity in the Far East, including efforts in China and Japan to secure the creation of direct connections with other continents. The accounts show a net profit of 5,597,000 fr. permitting of the payment of a dividend at the rate of 40 fr. per share, and the carrying forward of 758,000 fr.

The report of the *Société de l'Energie Electrique du Littoral Méditerranean* for last year shows a net profit of 12,080,750 fr., as compared with only 7,662,144 fr. in 1922. A dividend of 7½ per cent. is being distributed.

The report of the *Société Le Triphase*, of Paris, for last year shows a net profit of 8,169,020 fr., as compared with 2,465,022 fr. in 1922.

La Société Electrique Lille-Roubaix-Tourcoing reports a net profit of 1,874,338 fr. for the last financial year, an increase of 115,921 fr.

The report of the *Société des Constructions Electriques de France*, of Paris, for the last financial year, shows a net profit of 257,775 fr., as compared with only 38,639 fr. in 1922.

Stock Exchange Notices.—The Committee has ordered the undermentioned to be officially quoted:—

Cawnpore Electric Supply Corporation.—1,493 ordinary shares of £1 each, fully paid, Nos. 158,508 to 160,000.

Bournemouth and Poole Electricity Supply Co.—60,000 ordinary shares of £1 each, fully paid, Nos. 550,001 to 610,000.

Dealings in the following have been specially allowed by the Committee under Rule 159:—

Hoffmann Manufacturing Co.—500,000 7½ per cent. cumulative preference shares of £1 each, fully paid, Nos. 250,001 to 750,000.

Shropshire, Worcestershire, and Staffordshire Electric Power Co.—£750,000 5½ per cent. first debenture stock (conversion stock fully paid and stock paid by instalments), issued at 97½ per cent., fully paid and partly paid.

Cawnpore Electric Supply Corporation.—1,493 ordinary shares of £1 each, fully paid, Nos. 158,508 to 160,000.

Midland Counties Electric Supply Co.—25,000 new ordinary shares of £1 each, 5s. paid and fully paid, Nos. 975,001 to 1,000,000; and 250,000 new 6 per cent. cumulative preference shares of £1 each, 5s. paid and fully paid, Nos. 750,001 to 1,000,000.

Reading Electric Supply Co.—152,125 shares of £1 each, fully paid, Nos. 1 to 152,125.

North of Scotland Electric Light and Power Co.—After making provision for income tax and reserve for the renewal of plant, writing off balance at debit of battery maintenance account, meeting debenture and loan interest and preference dividend, and adding the amount brought forward from last year, there remains a net revenue balance of £6,246. An interim dividend of 3 per cent. on the ordinary shares has been paid, free of tax, and a further dividend of 4 per cent. is to be paid, free of tax, £2,000 placed to general reserve account, and £746 carried forward.

Waygood-Otis, Ltd.—The net profit for the year 1923-24 amounted to £52,384. To this is added £17,003 brought forward, making £69,387. The preference dividend requires £9,000, and the interim ordinary dividend absorbed £7,250. It is proposed to place £20,000 to reserve and £3,000 to staff pensions fund, to pay a final dividend of 5½ per cent. on the ordinary shares (making 8 per cent. for the year), and to carry forward the balance of £14,187.

West African Telegraph Co., Ltd.—The report for 1923 shows a gross revenue of £77,817 and a profit of £32,441. Adding £2,417 brought forward and £2,056 refunded income tax, a balance of £36,914 is available. The general reserve receives £25,000; £913 is set aside for taxes; a dividend of 4 per cent., free of tax, is recommended; and a balance of £1,758 is to be carried forward. The meeting was held yesterday (Thursday).

Victoria Falls and Transvaal Power Co., Ltd.—The directors have declared a final dividend of 4 per cent. upon the preference shares (making 10 per cent. for the year, as in 1922), and a dividend of 3 per cent. in respect of the current year. The ordinary shares also receive a dividend of 10 per cent., as compared with 8 per cent. in 1922.

Dutch East Indies.—The Allgemeene Nederlandsch-Indische Electriciteits Maatschappij, which has a capital of nine million guilders, reports a net profit of 1,174,285 guilders for the past financial year, as compared with 1,015,715 guilders in 1922. The dividend is being increased from 10 to 11 per cent.

British Columbia Telephone Co., Ltd.—After providing for depreciation, but before allowing for debenture service, the accounts for 1923-24 show a profit of $588,638. Dividends on the ordinary shares total 8 per cent. for the year, the pension fund receives $12,500, the fire loss reserve $35,147, and $78,292 is transferred to surplus.

Falkirk Iron Co., Ltd.—The net profit for 1923-24 was £18,629, and to this is added £26,763 brought in, making £45,392. A dividend of 7 per cent. (against 10 per cent.) is to be paid on the ordinary shares, and £24,699 carried forward, subject to taxation.

Edgar Allen & Co., Ltd.—The profit for 1923 was £23,231, and to this was added £9,523 brought forward, making £32,754. An interim dividend of 6d. per share was paid, but the directors are unable to recommend a further distribution. A balance of £7,543 is carried forward.

James Keith & Blackman Co., Ltd.—After providing for depreciation, debenture interest, preference dividends, &c., the available balance from trading in 1923-24 was £24,141. A dividend of 7½ per cent., free of tax, is recommended, leaving £9,141 to be carried forward.

Ransomes, Sims & Jefferies, Ltd.—The preference dividend in respect of the eighteen months ended December 31st, 1922, is to be paid, but the profits are insufficient to allow of a dividend on the ordinary shares for 1923-24.

British Columbia Electric Railway Co., Ltd.—Dividends of 3½ per cent., free of tax, have been declared upon the preferred and deferred ordinary stocks in respect of the year ending June 30th.

Italian Company.—The capital of the *Società Unión Italiana dei Tramways Elettrica*, of Genoa, is being increased from 25 to 30 million lire.

Wellman Smith Owen Corporation.—A dividend of 10 per cent. is paid out of profits of £29,353 for 1923, and £23,165 is carried forward.

Montreal Light, Heat and Power Consolidated.—A dividend of $1.75 per share has been declared upon the common shares for the quarter ending July 31st., payable August 15th.

Quebec Railway, Light, Heat and Power Co., Ltd.—Quarterly dividend of $1.75 per share on the 7 per cent. cumulative preference shares, payable July 15th.

French Indo-China.—The report of the *Société Indo-Chinoise d'Electricité* for last year shows a net profit of 855,645 fr., as compared with 676,242 fr. in 1922.

Spanish Company.—The *Société des Transports et Force Motrice en Espagne* reports a profit of 255,099 fr. for the last financial year.

Belgian Company.—The report of the *Société d'Electricité du Nord de la Belgique* for last year shows a net profit of 3,739,485 fr., as compared with 2,608,112 fr. in 1922.

Yorkshire (West Riding) Electric Tramways, Ltd.—A dividend for the half-year to June 30th has been declared on the 6 per cent. preference shares.

General Electric Co., Ltd.—The directors announce a dividend of 1s. per share (5 per cent. per annum) for the year to March 31st, 1924, the same rate as for the previous year.

Kaministiquia Power Co., Ltd.—Quarterly dividend of $2 on common shares, payable August 15th.

American Telephone & Telegraph Co.—Quarterly dividend of 2¼ per cent. on capital stock, payable July 15th.

Stocks and Shares.

MONDAY EVENING.

THE principal feature in the Stock Exchange markets is the outstanding strength of investment securities, while another conspicuous factor in City circles is the outpouring of new issues from all nations, kindreds, and companies. The public appetite for investment stocks and shares is surprisingly keen, and the stag, who has been doing very well of late out of many new issues, helps to emphasise the success of appeals for fresh capital which are being made daily. An interesting issue is that of a million pounds 6 per cent. first mortgage debenture stock at 94 and a million 7½ per cent. preference shares of £1 each at par by the Whitehall Electric Investments, Ltd. This came out as an offer for sale, and many of the particulars given were contained in a letter from the chairman of the Whitehall Trust, Ltd. The subscription lists were due to close on Thursday in this week. The old preference at 21s. 6d. were 6d. down on the appearance of the new issue, and the debenture eased off to 96.

London Electrics at 31s. have put on another sixpence. Otherwise the list of London shares is unchanged. The market is very steady, with a fair amount of trade going on in the leading descriptions. Amongst these, County of London command about the freest market, speculative interest being aroused in this company to a greater extent than it is with most of the others, the probable reason being the impression that the County Company offers so wide a scope for expansion of area, &c., in future.

Home Railway stocks are mostly easier. Metropolitan Consolidated has dropped to 80¼, Underground income bonds to 93, and Districts to 51¼. Steam stocks are not by any means a good market. The pre-ordinary securities, however, are firm. There is no stock, for instance, to be obtained in the Central London 4½ per cent. debenture. Buyers can get £25,000 City & South London 4½ per cent. debenture and £1,500 London Electric 4½ per cent. debenture, both at 95½, yielding £4 13s. 6d. per cent. on the money, with interest in January and July. These stocks are guaranteed as to principal and interest by His Majesty's Government. There is a small amount of London Electric 4 per cent. preference obtainable at 80½, with dividends due in February and August, and paying practically 5 per cent. on the money, allowing for accrued interest. District prior-charges, however, are extremely scarce.

Cable stocks have again yielded ground. The annual reports from the Eastern Telegraph and the Eastern Extension show a falling-off in both cases, though the dividends are maintained at 10 per cent. The Eastern company is putting £300,000 to reserve, which is £100,000 less than the contribution of a year ago, while the Eastern Extension has reduced the amount placed to reserve this time to £250,000. The companies, however, are in an exceedingly strong position financially. Eastern ordinary has given way to 16¼. Other members of the group remain unaltered. Oriental Telephones are a little better at 38s. 9d. bid, on the report. Both the old ordinary and the new ordinary are to receive dividends, making 10 per cent., free of tax, to December 31st last, that on the new shares being calculated from the dates fixed for payment of instalments. At the Anglo-Portuguese Telephone meeting the other day, the Chairman, Lord St. Davids, declared that what the company needs is to be made independent of fluctuations in exchange. His company has asked for power automatically to increase its rates if exchange should fall further, and to substitute a message rate, instead of the flat rate which prevails to-day. Marconis are offered at 30s., the market in them still being heavy and uncertain.

British Electric Traction ordinary at 90 is 3 points higher, the meeting last week having a stimulating effect upon the price. The Chairman made the remarkable statement that if it were possible to offer the whole ordinary stock for sale in one block, he would not have the slightest difficulty in finding a number of purchasers at par. "I am equally certain I can find one," he continued, "who would give considerably above par." This robust faith in the company sent shareholders buying more stock, of which, by the way, there is not much floating supply in the market.

The London group of traction issues has scarcely moved in price. Mexico Trams are flat, owing to the diplomatic rupture which has occurred between this country and Mexico, and which, it is feared, may have a disadvantageous effect upon the English-owned utility concerns operating in the country. Mexico Tramways 6 per cents. are down to 48¼, and although Mexican Light & Power show little quotable movement, the market in them is weak and heavy.

Siemens rose to 19s. 3d. on the return of the shares to the dividend-list with an interim distribution of 6d., being at the rate of 5 per cent. per annum. India Rubbers are steady at 13s. 9d., although the directors deem it too early to frame a forecast of the year's working, and are therefore unable to recommend an interim dividend on the ordinary shares. The General Electric has announced a dividend of 5 per cent., which meets the anticipations of the more cautious prophets. A half-crown rise took Henley's preference to 4¼. Edisons are a shade easier than the nominal price suggests. Babcocks keep hard at 47s. 6d.; some people are inclined to think the shares fully valued, for the time being, at this price. Iron and steel shares have a rather better tendency, and the rubber market is as placid as a stagnant pool.

Share List of Electrical Companies.

HOME ELECTRICITY COMPANIES.

	Nom. £	Dividend. 1922.	Dividend. 1923.	Price June 23, 1924.	Rise or fall.	Yield. p.c.
Brompton Ordinary	1	12	10	37/-	—	*£5 8 1
Charing Cross Ordinary	1	14	14½	42/-	—	6 18 2
do. do. do. 4½ Pref.	1	4½	4½	17/-	—	5 6 0
Chelsea	1	10	12	37/6	—	6 8 0
City of London	1	15	15	45/9	—	6 11 0
do. do. 6 % Pref. ...	1	6	6	23/6	—	5 2 2
County of London	1	10	15	47/-	—	6 7 8
do. do. 6 % Pref. ...	1	6	6	1¼	—	5 6 8
Edmundson's Ordinary	3	7	7	5	—	4 4 1
do. 6 % Pref.	5	6	6	5⅜	—	5 11 7
Kensington Ordinary	5	12	14	9¾	—	7 3 7
London Electric	1	10	10	31/-	+6d.	6 9 0
do. do. 6 % Pref. ...	5	6	6	5⅜	—	5 11 7
Metropolitan	1	8¾	10	1¾	—	5 14 3
do. 4½ % Pref.	1	4½	4½	17/-	—	5 6 0
Newcastle-on-Tyne Ordinary ...	1	2½	6	18/9	—	6 8 1
do. 5 % Pref. ...	1	5	5	17/-	—	5 17 2
do. 7 % Pref. ...	1	7	7	24/-	—	5 16 8
Notting Hill 6 % Pref.	10	6	6	9½	—	6 6 4
North Met. Elec. 6 % Pref. ...	1	6	6	21/3	—	5 13 0
Urban Ordinary	1	—	4	18/9	—	4 5 8
do 6 % Pref. ...	1	5	6	1	—	6 0 0
St. James' and Pall Mall ...	5	14½	17½	13⅜	—	6 10 10
South London	1	11	15	43/3	—	6 18 7
South Metropolitan Pref. ...	1	7	7	1½	—	5 12 0
Westminster Ordinary	5	12	15	10½	—	7 6 4
Whitehall Elec. Invst. 7½ % Pref.	1	7½	7½	21/6	—6d.	6 13 6

HOME RAILS.

Central London Ord. Assented Stock	4	4	68½	—	5 16 10
Metropolitan ... ... ,,	3½	4	80½	— ½	4 19 5
do. District ... ... ,,	3	3½	51½	— ½	6 16 0
Underground Electric Ordinary	10	Nil	Nil	2½	— ½	Nil
do. do. "A" ...	1	Nil	Nil	7/6	—	Nil
do. do. Income Bonds	5	6	93	—½	*6 9 0

TELEGRAPHS AND TELEPHONES.

		Dividend. 1921	Dividend. 1922			
Anglo-Am. Tel. Pref. ... ... Stock	6	6	103½	—	5 16 0
do. Def. ... ... ,,	1½	84/6	23⅝	—	6 5 8
Chile Telephone	6	6	6⅞	+ ⅛	4 9 0
Cuba Sub. Ord.	10	7	7	—	10 0 0
Eastern Extension...	10	10	10	16½	—	6 1 3
Eastern Tel. Ord. ... ... Stock	10	10	164½	—1	6 2 0
Globe Tel. and T. Ord.	10	10	10	17⅞	— ¼	5 15 3
do. do. Pref.	10	6	6	11¼	—	5 7 10
Great Northern Tel.	10	24	22	28	+ ½	7 17 2
Indo-European	25	10	7	83½	—	*5 6 1
Marconi	1	25	15	1½	—	10 0 0
Oriental Telephone Ord.... ...	1	12	12	1½	—	*6 8 9
United R. Plate Tel.	5	8	8	6¾	—	*5 18 6
West India & Panama	10	Nil	Nil	1/-	—	Nil
Western Telegraph	10	10	10	16½	—	6 3 1

HOME AND FOREIGN TRAMS, &c.

Anglo-Arg. Trams First Pref. ...	5	5½	12½	8¾	—	8 9 0
do. do. 2nd Pref. ...	5	Nil	5½	2⅛	—	10 4 4
do. do. 5% Deb. ...	Stock	5	5	72½	—	6 18 0
British Electric Traction Ord. ...	,,	4½	5	90	+3	6 13 4
do. do. 6% Pref. ...	,,	6	6	103	+ ½	5 16 6
Brazil Traction	100	Nil	4	57	—	7 0 0
Brit. Columbia Elec. Rly. Pcc.	Stock	5	5	87½	+1	5 14 3
do. do. Preferred	,,	5	96/-	87½	—	*5 10 9
do. do. Deferred	,,	8	127/-	104½	—	*6 4 0
do. do. Deb.	,,	4½	4½	81½	—	5 4 4
Lond. & Sub. Trac. 5 % Pref. ...	1	3½	5	7/-	—	7 2 10
London United Tram. Deb. ...	Stock	4	4	48	—	8 6 8
Mexico Trams. 5% Bonds ...	—	Nil	Nil	70½	—2	7 1 10
do 6% Bonds ...	—	Nil	Nil	48½	—2	Nil
Mexican Light Common ...	100	Nil	Nil	18	— ½	Nil
do. Pref.	100	Nil	Nil	46½	—	Nil
do. 1st Bonds ...	—	Nil	5	85½	—	7 12 8

MANUFACTURING COMPANIES.

Babcock & Wilcox...	1	15	20	47/6	—	*5 1 2
British Aluminium Ord.... ...	1	10	5	24/6	—	4 1 8
British Insulated Ord.	1	15	15	2¾	—	5 14 3
Callenders	1	15	15	2⅞	—	5 17 0
do. 6½ Pref....	1	6½	6½	23/9	—	5 9 5
Crompton Ord.	1	10	5	⅞	—	8 17 10
Edison-Swan	4/-	Nil	7½	5/-	—	6 0 0
do. ,, 5% Deb.	Stock	5	5	77½	—1	6 9 0
Electric Construction	1	10	10	1⅝	—	6 7 5
English Electric	1	8	5	16/9	—	5 19 5
do. do. Pref.	1	6	6	19/6	—	6 3 1
Gen. Elec. Pref.	1	6½	6½	23/-	—	5 13 1
do. Ord.	1	10	5	19/9	—6d.	5 1 3
Henley	1	15	15	2⅜	—	5 14 3
do. 4½ Pref.	5	4½	4½	4½	+ ½	5 6 0
India-Rubber	1	10	10	½	—	*7 5 6
Met.-Vickers Pref....	2	8	8	2⅞	—	6 11 2
Siemens Ord.	1	10	10	19/3	+6d.	5 4 0
Telegraph Con.	12	20	20	24½	—	*4 18

* Dividends paid free of Income Tax.

Market Quotations for Chemicals and Metals.

IT should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general and they may vary according to quantities and other circumstances.

CHEMICALS, &c.	Price June 24.	Fortnight's Inc. or dec.
a Acid, Oxalic ... ... per lb.	5¾d.	...
a Ammoniac, Sal ... ... per ton	£60	...
a Ammonia, Muriate (large crystal) ,,	£52	...
a Bisulphide of Carbon ... ... ,,	...	...
a Borax ... ... ,,	£25	...
a Copper Sulphate ... ... £25 10s.		...
a Potash, Chlorate ... ... per lb.	4d. to 4½d.	...
a ,, Perchlorate ... ... ,,	4½d.	...
a Shellac ... ... per cwt.	£15 15s.	...
a Sulphur, Sublimed Flowers ... ,,	£7 15s.	...
a ,, Roll ... ... ,,	£7 15s.	...
a Soda, Chlorate ... ... per lb.	3d.	...
a ,, Crystals ... ... per ton	£5 to £5 5s.	...
a Sodium Bichromate, casks ... per lb.	4½d.	...
METALS, &c.		
b Aluminium, Ingots ... ... per ton	£125 to £130	...
b ,, Wire ... ... per lb.	1/9 to 2/6*	...
b ,, Sheet ... ... ,,	1/6 to 2/-	...
p Babbitt's Metal and Anti-friction Metal—		...
Grade I ... ... per ton net	£208	£3 inc.
Grade II ... ... ,, ,,	£150	£2 inc.
Grade III ... ... ,, ,,	£86	£1 inc.
c Brass (rolled metal 9" to 12" basis) per lb.	9¼d.	...
c ,, Tubes (solid drawn) ... ,,	1/- to 1/0½d.	...
c ,, Wire, basis ... ... ,,	9¼d.	...
c Copper Tubes (solid drawn) ... ,,	1/1½d.	...
c ,, Bars (best selected) ... per ton	£92	£2 dec.
c ,, Sheet ... ... ,,	£92	£2 dec.
c ,, Rod ... ... ,,	£92	£2 dec.
d ,, (Electrolytic) Bars ... ,,	£66	£2 dec.
d ,, ,, Sheets ... ,,	£143 10s.	...
d ,, ,, Wire Rods ,,	£76	£2 dec.
d ,, ,, H.C. Wire per lb.	9⅛d.	⅛d. dec.
f Ebonite Rod ... ... ,,	2/- to 3/6	...
f ,, Sheet ... ... ,,	2/- to 3/6	...
g German Silver Wire ... ... ,,	2/3	...
h Gutta-percha, fine ... ... ,,	nom.	...
h India-rubber, Para fine ... ... ,,	11d.	½d. dec.
Iron Pig (Cleveland Warrants) ... per ton.	£5 2s. to £5 2s. 6d.	...
i ,, Wire, galv. No. 8, P.O. qual. ,,	£45	...
g Lead, English Pig ... ... ,,	£33 10s.	10s. dec.
g Mercury ... ... per bot.	£13 5s.	...
e Mica (in original cases) small ... per lb.	8d. to 3/-	...
e ,, ,, medium ,,	4/- to 8/-	...
e ,, ,, large ... ,,	10/- to 20/- & up.	...
p Phosphor Bronze, plain castings ,,	1/3½	...
p ,, ,, drawn bars & rods ,,	1/4½	...
p ,, ,, rolled strip & sheet ,,	1/3½	...
p ,, ,, wire ... ... ,,	1/3½	...
o Platinum ... ... per oz.	£24	...
d Silicium Bronze Wire ... ... per lb.	1/0½	...
r Steel, Magnet, in bars ... ... ,,	8d.	...
n Tin, Block (English) ... ... per ton.	£225 to £226	£6 10s. to £7 inc.
n ,, Wire, Nos. 1 to 16 ... ... per lb.	3/8	...

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

The Dewpoint Temperature of Gases from Combustion.—ADDENDUM.—With reference to two paragraphs in Mr. J. N. Waite's article on this subject (3rd par., 1st col., p. 955, and paragraph commencing at foot of 1st col., p. 955), which are open to misconception, we have obtained from the author the following note :—" When calculating the respective volume of gas, and the respective volume of water vapour, at various temperatures, to arrive at dewpoint temperature of a gas-vapour mixture, by the method indicated in the article, the respective volumes are calculated at the respective partial pressures of gas and water vapour. Thus assuming a standard atmospheric pressure, the total pressure of the gas-vapour mixture will be 14.73 lb. per sq. inch; at 80 deg. F. the partial pressure of the water vapour, assuming the mixture to be fully saturated, will be 0.5 lb. per sq. inch, and the partial pressure of the gas will be 14.73 − 0.5 = 14.23 lb. per sq. inch. The volumes required are those corresponding to the respective temperature and partial pressure."

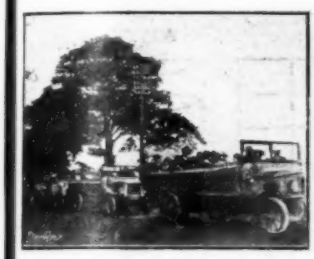
Lifting Jacks for Omnibuses.—Early this week the London General Omnibus Co., Ltd., demonstrated to the Press a new type of lifting jack for use with the London omnibuses. This jack has a lifting capacity of from 10 to 15 tons, and its size precludes its being carried on the vehicle. Arrangements have therefore been made to keep the gear at special stations distributed over the many routes of the company so that it can be brought to a disabled 'bus in a matter of a few minutes. The front of a 'bus is raised by inserting the jack under the cross members. For raising the rear of a 'bus the claw of the jack is placed under the hub of a back wheel. Tests with the jack show that it is possible to raise a 'bus 6 in. in 28 seconds.

The Incorporated Municipal Electrical Association.

Annual Convention at Chester.

(*Continued from p. 996.*)

On Wednesday, June 18th, the morning session was devoted to the reading and discussion of a paper by Councillor W. Hammer, J.P., Mayor of Hackney, which gave an opportunity for the committee-men to express their views; the occasion was marked also by extremely interesting contributions by Mr. B. Sankey, electrical engineer to the Corporation of Johannesburg, and Mr. G. Allbut, electrical engineer to the Corporation of Newcastle, N.S.W., who naturally compared the conditions obtaining here with those that they met with in their respective towns. In the afternoon, at the invitation of the Mayor of Chester, most of the visitors enjoyed a delightful trip up the River Dee in launches, making the discovery that the river, which was unattractive as seen below the city on the previous day, rivalled the Thames for beauty upstream, and offered wide



On the road to Queensferry.

The official photograph in Abbey Square—back view.

reaches admirably adapted for boating. Disembarking at Eccleston Ferry, most of the members walked to Eaton Hall, the seat of the Duke of Westminster, and were shown over the principal rooms, the beautiful architecture and rich decoration of which were much admired; proceeding through the hothouses and grounds, which were equally delightful, a short walk brought them to Iron Bridge, where tea and light refreshments, served in a large marquee, were heartily appreciated. Afterwards a hastily organised regatta, under the expert management of Lieut.-Col. W. A. Vignoles, afforded both entertainment and excitement until the lateness of the hour necessitated a return to Chester. There were about a dozen entries for the men's pair-oar race, with ladies steering, which was rowed in heats up to the semi-final; time did not permit of the completion of the contest, in which Messrs. H. Bell and A. J. Beckett, and Messrs. T. A. Kingham and H. Leigh Mossley, were the semi-finalists and were awarded prizes. In the mixed pair-oar race the winners were Mr. and Mrs. Sabine. This excursion was altogether most successful and enjoyable, and took place in charming weather.

In the evening private meetings were held by the chairmen and committee members on the one hand, and the engineers on the other, whilst those not thus occupied passed the time in dancing at the Grosvenor Hotel.

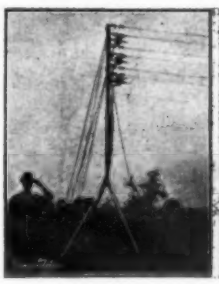
Thursday morning was spent in reading and discussing a paper by Mr. J. N. Waite, M.I.E.E., of Stoke-on-Trent electricity department, on "Performance Guarantees for Power Plant, with reference to Official Acceptance Tests." In the afternoon the party divided, a large portion visiting the works of the British Insulated & Helsby Cables, Ltd., at Helsby, whilst many others went to Messrs. Bees' Nurseries, the latter contingent returning to an At Home held by the Mayoress of Chester (Mrs. C. P. Cockrill) at the Town Hall.

A match between Chester Golf Club and the I.M.E.A., arranged by the Sheriff of Chester (Lieut.-Col. W. A. V. Churton, D.S.O., T.D.), deputy chairman of the Electricity Committee, took place during the afternoon.

In the evening the annual dinner was held at the Town Hall, over 300 covers being laid. After the toast of "The King," proposed by the President, Mr. S. E. Britton, "The City and County of the City of Chester" was proposed by Dr. Dewar, chairman of the Glasgow Electricity Committee. Dr. Dewar declared that Glasgow owed its prosperity to the City of Chester, in that a Chester engineer was summoned to Glasgow to deepen the Clyde, in which undertaking he was successful—thus opening the river to shipping and enabling the city to become a great commercial centre.

Musical honours were accorded to the Mayor of Chester, who responded, recalling the days when Chester was a busy port, and claiming for it the distinction of being unique among cities. Mr. Claude C. Taylor, chairman of the Chester Electricity Committee, also responded, expressing the pride of the City in having for its electrical engineer Mr. Britton, who averted the danger that Chester would be absorbed in an Electricity District by securing for the City the Queensferry power station—a transaction which had been fully justified by success beyond all expectations.

Dr. S. Z. de Ferranti proposed "The Incorporated Municipal Electrical Association," remarking that the attendance was larger by 200 than at any previous Convention, a fact which indicated increased interest in the supply of electricity in this country. The Association had done excellent work, and the success of municipal undertakings was very largely due to the engineers, who made the business their hobby. Mr. Britton was doing splendid pioneering work in carrying the supply of electricity into the rural districts round Chester, and his example should be followed, in order that the large country population should enjoy the benefits of electricity. Selfish views should be abandoned—they should think of the public, not the local public but the national welfare. They must advertise electricity and educate the public.



Terminal pole on the 33,000-volt line.

Leaving Queensferry for Hawarden Castle.

The President, Mr. S. E. Britton, responding to the toast, expressed agreement with Dr. Ferranti's views, and referred to the hard work imposed upon the Council and committees and the honorary officials in carrying out their duties. The Bill of 1919 had been shorn of its value by financiers and company promoters, and it was impossible to develop the industry as it ought to be developed; a most pressing problem was the removal of the restrictions on the spread of electricity through rural districts. More advertising had been done at this than at any other Convention.

The Sheriff of Chester proposed "Our Guests and Ladies," in a witty speech, and Mr. Ll. B. Atkinson responded, describing the I.M.E.A. Convention as the most attractive event in the electrical calendar. The extension of electricity supply into the country was, in his opinion, a most urgent problem; the price at which

the supply could be given need not trouble them—it would be gladly taken at 1s. a unit. New ideas were needed, and they might have to go to the Electricity Commissioners and ask them to slacken some of the regulations. He congratulated the City on its engineer's bold schemes and thoroughly sound construction. Replying on behalf of the ladies "and as a lady," Mr. Atkinson gave his humour free play, and pointed out that whilst engineers were out to increase the domestic load, the ladies wanted that load reduced—especially in respect of the washing-up problem, for which he suggested an electrolytic solution.

The President proposed the health of the oversea engineers who were attending the Convention—Messrs. Taylor, Allbut, and Sankey—and Mr. Sankey responded, conveying fraternal greetings from the M.E.A. of South Africa, as well as good wishes from the S.A. Institute of Electrical Engineers, of which he was president. He said it was a great pleasure to see so many prominent business men from this country visiting South Africa since the war, to look into things for themselves, and suggested that supply engineers should do the same: for many years they had used 80,000-volt transmission, and they would shortly go to 150,000 volts, whilst they were building a super-station to run at 100 per cent. load factor, with coal delivered to the bunkers for 2s. 6d. a ton—the cheapest electricity supply in the world.

Mr. S. J. Watson proposed a hearty vote of thanks to Mr. and Mrs. Britton for the excellent work they had done in organising the Convention, and the President, in responding, bore witness to the great help he had received from Mrs. Britton.

(To be concluded.)

Power Plant Chemistry.

By W. M. MILES, A.I.M.E., F.C.S. *(Abstract.)*

THE power plant chemist should have a good practical and theoretical knowledge of organic and inorganic chemistry, iron and steel analysis, fuel and refractory materials, the chemistry of oils, fats and waxes, heat and heat engines, electricity and magnetism, together with some knowledge of physical chemistry and mathematics, and a habit of never being too old or important to learn.

Coal.

It is absolutely essential that a standard method of sizing, sampling, and testing coal should be agreed upon, so that concordant results by any assistant are obtained. Coal containing excessive amounts of fine matter usually results in greater quantities of riddlings falling through the bars of the chain grates.

Fig. 1 shows the decrease in carbon content and volatiles, and the increase in ash with variation in size of sample, for both washed and unwashed coal. These curves are derived from tests on Kiveton Park dry slack and Waleswood washed nuts.

The trouble due to excessive riddlings can be materially reduced by wetting the coal, not in the hopper, but as it is dumped into the bunker. This seems to bind the mass together and prevents, to a large extent, the riddlings passing through, while the segregation of the larger pieces of coal at the sides of the hopper, leaving the fine matter in the centre, is considerably neutralised and the consequent unevenness of the fuel bed is kept within reasonable limits.

Many stations have now adopted the practice of wetting the coal, and better steaming conditions and efficiency are claimed as a result. It is obvious that any water added has to be evaporated at the expense of a certain amount of heat in the coal, but this loss is apparently more than neutralised by the increased economy obtained with better combustion on a more even fire grate, permitting high CO_2 and furnace temperature, due to less excess air being used.

The sampling of coal, whether from trucks or furnace hoppers, is very important, as any error at this point renders subsequent analysis worthless. In sampling coal from wagons, due consideration must be given to the class of coal, distribution of shale and slate, and the number of wagons involved. For instance, while one or two shovelsful from each wagon of a consignment of twenty or thirty would be sufficient to obtain an average sample, they would be useless for two or three wagons. A proportionate system of sampling should therefore be enforced to ensure comparative and reliable tests being obtained in the laboratory. The hopper sample is most necessary from the economical standpoint. When taking the hopper sample from different-sized units, the amount of coal contributed by each boiler to the average sample should be proportional to the steaming capacity, or where possible to the weight of coal burnt.

The burning of powdered coal seems a convenient method of utilising fine matter, which besides being a cheap fuel would entail a smaller cost for pulverisation.

Excessive free moisture added at the colliery is prejudicial to the buyer, and has to be paid for and transported at fuel rates. This is of great importance with washed fuel, where the percentage of moisture increases as the size of the coal diminishes. (See fig. 1.) If wetting the coal is adopted, the water should be added at the station, not the colliery.

Sulphur determinations should always be made on new coals received. When coal is wetted to permit of better combustion, only enough water to obtain this end should be used, as, with too much, impurities washed from the coal, containing large amounts of chlorides, sulphates and earthy matter, are deposited on the links of the grates, &c., clogging up the air spaces and causing overheating.

Next to chimney losses those due to ash are the most important. The amount of ash found in coal increases as the size diminishes. The tendency of combustible matter to be present in the ash as dumped increases, with the ash content; the amount of heat discarded increases proportionately with the ash dumped at furnace temperatures, and the amount of air required for combustion, although theoretically less as the ash increases, is actually more.

The ash from certain coals gives rise to considerable trouble due to fusing and clinkering. This matter has been thoroughly dealt with by Messrs. Fieldner, Hall, and Field in "The Fusibility of Coal Ash and the Determination of the Softening Temperature," issued by the American Bureau of Mines.

An ash with a low fusion point is invariably troublesome, the natural result being the inclusion of combustible matter in

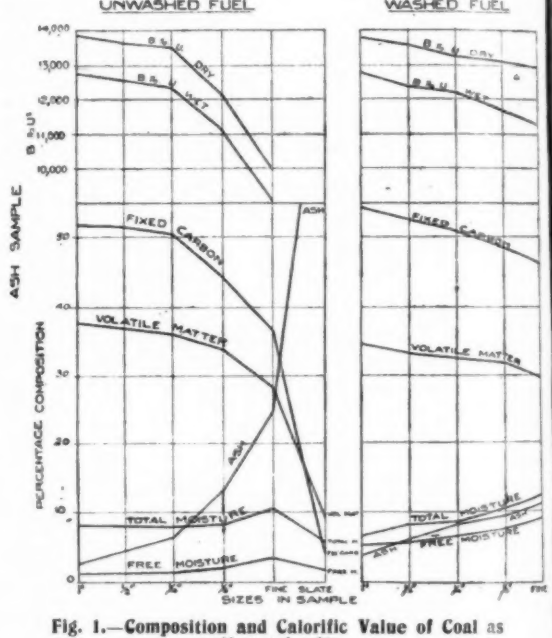


Fig. 1.—Composition and Calorific Value of Coal as Affected by Size.

the ash when fusion takes place. A more serious trouble, however, is often experienced when the large coal segregates at the sides of the furnace hopper, thus providing a freer admission of air and consequent better combustion and higher temperatures than at the centre of the grate. Naturally the tendency to fuse is greater at the sides, and this usually results in the fused ash adhering to the side walls supporting the arch, causing a growth of clinker from the wall towards the centre of the grate, which, besides making uneven fires and reducing the effective grate area, acts as a barrier to the fuel supply and reduces the steaming capacity of the boiler.

Furnace crowns also suffer considerably due to low fusibility ash, but whilst the depressions are chiefly due to erosion by flame propagation, lifting of small coal and fusing of the refractory materials, deterioration is greatly accelerated when the low-fusing-point ash deposits and acts as a flux.

With regard to choice of fuels, the fusibility of ash should be taken into consideration; usually those coals with a lower ash content are to be preferred, but where fusible ashes are encountered priority ought to be based on actual practice, since it is quite possible for a coal of low ash content of fusible nature to entail more trouble, and waste due to fusing and clinkering, than coal of higher ash content of infusible nature.

CALCULATION OF FUSION POINTS OF COAL ASH FROM ANALYSIS.

$$17.01A + 15.56B + 6.06C = \text{Fusion Temp. (°C).}$$

Where A = % $Al_2O_3.2SiO_2$.
B = % Remaining SiO_2.
C = % Fe_2O_3.

The nearer the composition of the ash is to the true silicate of alumina ($Al_2O_3.2SiO_2$), the more infusible it will be. The

formula given herewith, deduced from a large number of tests by the author, has proved very useful.

The presence of ferruginous matter in ash is easily detected by the reddish colour found; a red ash may be regarded as one of low fusibility, the degree varying with the intensity of the colour.

A system of sampling the ash from each boiler should be employed; samples taken regularly from different firemen eventually give useful information as to whether the coal, boiler, or fireman is at fault, and wherever it is found the trouble should be put right.

Slicing bars should be used judiciously at intervals to remove any fused clinker; this will permit of combustion on the whole grate, while a more uniform arch temperature, which is essential for furnace and refractory life and proper combustion, will be the result.

The purchase of coal on a calorific, or purity, basis, sooner or later, must be adopted. As an alternative to a B.th.u. basis, suitable grades of coal in which size, ash content, and moisture are fixed as standards should at least be possible. Naturally the ash content would vary with the geological situation.

The proximate and ultimate analysis of a coal supplies valuable information as to its potential properties, but from the economic and useful point of view its heating value is most important. A bomb calorimeter, in which hydrogen, carbon, and sulphur, in addition to B.th.u. can be determined, is a very useful piece of apparatus; it is a regrettable fact, however, that even with high-grade instruments, the most suitable coal cannot be determined, because many a coal giving satisfaction in the laboratory causes considerable trouble in the boiler house. Laboratory tests on new coals should be followed up by a trial on a boiler under actual conditions, but the purchase of a fuel has to be judged chiefly on the data supplied by the laboratory.

The author has attempted to make allowances for the following:—

(*a*) Variation and increase of ash content.
(*b*) Variation of combustible in dumped ash, and amount of useful heat discarded with this at 1,000 deg. F.
(*c*) Variation in quality and grade of fuel, with excess air required in practice and unavoidable loss due to moisture and combustion of hydrogen, these being worked to a final temperature of 350 deg. F.

In fig. 2 the author plots a curve for suitability factor; this factor enables the commercial value of the coal to be ascer-

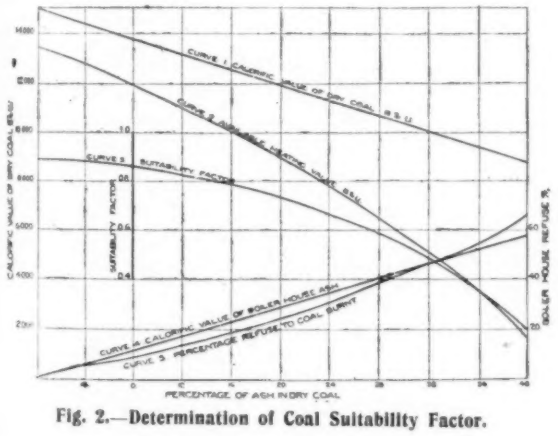

CURVE 1 CALORIFIC VALUE OF DRY COAL B.Th.U.
CURVE 2 SUITABILITY FACTOR
CURVE 3 SUITABILITY FACTOR
CURVE 4 CALORIFIC VALUE OF BOILER HOUSE ASH
CURVE 5 PERCENTAGE REFUSE TO COAL BURNT
CALORIFIC VALUE OF DRY COAL B.Th.U.
SUITABILITY FACTOR
BOILER HOUSE REFUSE %
PERCENTAGE OF ASH IN DRY COAL

Fig. 2.—Determination of Coal Suitability Factor.

tained when the price, the dry calorific value, and the cost of handling the ashes are known.

The curves shown in fig. 2 are as follows:—

No. 1.—Plotted on dry ash and dry calorific values of coals from district coalfields.
No. 2.—Curve deduced after making allowances for *a*, *b* and *c*.
No. 3.—Ratio of No. 2 to No. 1, which may be used for practically any coal, given the dry B.th.u., thus amounting to a suitability factor.
No. 4.—Estimated calorific value of boiler house refuse as the quality of the coal varies.
No. 5.—Percentage of refuse to coal burnt, deduced from No. 4.

For comparing the value of different fuels, the following formula can be used:—

(Useful heating value in B.th.u. × 2,240) ÷
(Price per ton in pence plus ash handling charges.)

or

(B.th.u. dry × suitability factor × 2,240) ÷
(Price per ton in pence plus ash handling charges.)

equals B.th.u. per penny on dry coal.

This is not purchasing coal on a calorific basis, for although the suitability factor is first deduced from dry B.th.u. as determined in the laboratory, allowances have been made to estimate what would be the result of burning it under actual conditions.

It suggests an alternative when an actual trial on a boiler is out of the question, and a means of choosing from the analysis of small samples sent in from spot lots in the market, the best and most suitable.

Washed fuel contains less ash than dry fuel of equal size, and will have lower ash values than the curves indicate.

The foregoing formula can be applied to various grades of coal burnt on mechanical stokers, but it is obviously unsuitable for powdered fuel where boiler refuse alone is considerably better as regards heat loss, than with the ordinary methods of firing.

There is no doubt that a suitability factor is necessary to make the actual analysis of coal as obtained in a laboratory useful, and to estimate the potentialities of any coal where possibly boiler tests cannot be carried out.

Generally it has been found that coals falling below the laboratory estimate are either unsuitable or uneconomical, while those giving approximately the same, or higher, results than estimated, are suitable coals for selection.

Water.

Primarily the treatment of feed water is to eliminate the following troubles:—(1) Scale and other matter deposited in boiler drums, tubes and piping, (2) Priming, and (3) Various forms of corrosion.

Experience with the various forms of apparatus on the market proves that scale can be more or less eliminated.

Usually concentrations of sodium carbonate and hydrate have been considered the chief cause of priming; however, many engineers claim that priming will not occur provided such insoluble impurities as mud, oil, soap wastes, and matter in suspension are absent.

Research has proved that with practically all natural waters corrosion stops with the removal of oxygen, but there are so many openings for its admission about the power plant that it presents, without a doubt, the most serious drawback to efficient boiler life. Evaporators remove most of the impurities from feed water, including dissolved oxygen. Make-up feed water, whether raw supply or discharge from softeners, should be given special attention; the assumption that water leaving the softener requires no further treatment often results in considerable trouble.

Usually it is advised to keep the alkalinity slightly above the degree of hardness as the water leaves the softener; very often, however, condenser leakage permits of scale-forming matter reaching the boiler, and additional chemicals are required for its neutralisation. It appears, therefore, that where softeners of the lime soda type are installed, the lime should be controlled from the softener outlet, and the soda from the boiler to ensure all water being treated. No excess of lime should be allowed to leave the softener except in special cases of corrosion, where possibly a thin lime carbonate scale on the parts affected would act as a preventative.

The degree of free alkalinity within a boiler should be due to sodium salts only, which, kept at a reasonable standard varying with the class of water, dissolves any free CO_2 and allows for any fluctuations in hardness and quality of water entering the feed line.

It follows therefore that, besides testing and treating the make-up, it is always advisable to sample the water as used in the boiler. Samples regularly tested for hardness, free alkalinity, and sodium chloride provide most useful information for variation of treatment, concentration, and blow-down.

Where condenser leakage is experienced, samples of condensate should be tested daily, so that any undue amount of hard water is kept out of the boilers. The amount of leakage can be determined by the silver nitrate method or by means of the Dionic water tester, while there are various forms of apparatus on the market for indicating leakage automatically.

The condensate should also be tested at intervals for dissolved air, and wherever possible discharge tanks should be enclosed and steam sealed to prevent contamination with air.

The samples should always be examined for oil, which may be detected on the surface, as a check that the glands are being kept tight to prevent oil getting to the boilers.

As all water used on the system for steam generation is brought together in the boiler house feed tank, it is a convenient place to detect any excess of dissolved oxygen, which, on being found, can be traced to its source and rectified.

In many stations the circulating water contains corrosive manufacturing waste, acid ganister discharge, &c. This makes it imperative to carry out periodic analysis or daily test for various offending chemicals.

Oil and glutinous matter in circulating water are probably the greatest sources of trouble affecting condensing efficiency.

(To be concluded.)

Discussion.

Mr. D. WILSON said he had just returned from an extensive tour in the United States, and the impression upon his mind was that much greater attention was being paid to power plant chemistry there than in this country. In America every station engineer knew all about the fusing point of the ash, and it was entered in the proximate analysis as regularly as any other item. The burning of the cast iron in mechanical stokers was largely to be traced to the fusibility of the ash, as also were most of the troubles with the brickwork. The troubles were, perhaps, not quite so great when powdered fuel was used, but it might be that the troubles encountered with

powdered fuel in America had led engineers there to take such a deep interest in the fusibility of ash.

Mr. R. A. CHATTOCK (Birmingham) pointed out that the moisture content in washed fine coals was much larger than the 10 per cent. mentioned in the paper. In his experience it was nearer 20 per cent. and it was a much more serious problem with fine coals than with some of the larger kinds, because the water would not drain out so easily. It was only by constant analysis and test of the feed water that reliable and better results could be obtained. In America they were running boilers up to an average of 15 lb. per sq. foot, whilst the lower tubes of these boilers were run as high as 50 lb. per square foot without danger. That, however, could only be done by means of constant analysis.

Mr. R. DOWSON (Messrs. Parsons) urged the importance of paying constant attention to the uniform quality of the coal used in electric power stations. One of the best methods for increasing the thermal efficiency without increasing the steam temperature was to heat the feed water by steam withdrawn from the turbine, which brought in the question of using an economiser for recovering the heat of the flue gases. In many arrangements at present it was impossible to use the economiser at all. By the use of air preheaters for recovering the heat in the flue gases it was found that there was no trouble with the boiler furnace. This, however, brought in the question of composition of the coal, because the rate of heat transmission of the boiler was increased, but with unsuitable coal this increased rate of heat transmission had a deleterious effect upon the firebox and the grate. Therefore, all large coal users should certainly buy upon the basis of calorific value, even if they could not buy on a more scientific basis than that. Only in this way would they be able to make steam stations as efficient as Diesel engine stations.

Mr. R. B. MITCHELL (Glasgow) thought the outstanding feature of the paper was the method outlined for the determination of a factor of merit applicable to the scientific purchase of coal. At the same time he did not agree with the method described in the paper for the determination of moisture content and volatile content in the proximate analysis of coals. He had found in many cases that drying at a temperature of 100 deg. C. for four hours was necessary to expel all the moisture. Moreover, in certain cases, if the drying period were exceeded the sample gained weight, due possibly to some sort of oxidising action. In also disagreeing with the author's method for the determination of the volatile content, Mr. Mitchell said the best results were obtained by the use of an electrical muffle furnace with an adjustable resistance and ammeter, graduated to a temperature scale, in the circuit, thus ensuring that all the operations were carried out under similar temperature conditions, in his case 900 deg. C. He now had an all-electric laboratory for chemical testing work. Although congratulating the author upon the useful work he had done in endeavouring to draft a basis for the scientific purchase of coal, he was afraid they were some distance from getting coal agents to look at anything of a scientific nature and, in any case, the first result would be an increase in the cost. He suggested, however, an ash clause to ensure effective washing of the coal at the collieries. Present-day boiler test codes were in a hopeless state of confusion. The chemical water-softening plant should not be used alone in large modern plants for the production of make-up feed water; the discharge from the softener should be the initial stage in a circuit in which was installed evaporating and de-aerating plant. Where the make-up feed water was not of an alkaline nature and contained only a small amount of impurities in solution, and suspension, the chemical water-softener could be eliminated and only evaporating and de-aerating plant utilised. All main transformer oil at Dalmarnock was tested, under B.E.S.A. conditions, for dielectric strength, once per month, and samples breaking down below standard were further examined for moisture, acidity, sludging, &c. Lubricating oils were tested once every six months.

Mr. J. WRIGHT (Belfast) said the moisture content of coal had an enormous effect. It had been suggested that the Electricity Commissioners should devise some formula for calorific value, but he felt it would be far better for the I.M.E.A. to take it up, because if all municipal undertakings adopted the same basis, then the Electricity Commissioners and everybody else would have to adopt it. Certain comparisons were at present made by the Electricity Commissioners, but they did not know whether they were true comparisons or not because they did not know how the calorific values were arrived at.

Mr. W. C. P. TAPPER (Stepney) said a most important point was where the supply of suitable men for this chemical work was to come from. Most of the young men had not sufficient running experience, whilst the chemical knowledge of the regular staff was somewhat rusty. The selection of the right type of man was of great importance.

Mr. S. J. WATSON (Salford) said that his experience had shown that in the case of comparatively small washed slack the water content might be anything from 6 to 14 per cent., with an average of, say, 8 or 9 per cent. It was also important to purchase on the value of the coal as delivered into the bunkers because the weight which left the colliery and the weight when it reached the purchaser might vary within wide limits owing to gain or loss of moisture on the way. He specially wished to emphasise the importance of seeing that value for money was obtained with the washed slacks which so many of them were now using. If the tests were taken by an independent authority, the colliery people were not so likely to dispute the figures. One of the best methods of dealing with troubles with feed water was to ensure a closed system with a de-aerating plant for the make-up

Mr. T. HALL (Burton-on-Trent) said that he found that he was getting about ½ to 1 ton extra in every ten-ton truck, due to rain gathered on the way. He tried the effect of sending a sheet to the colliery to be put over the coal during transit, but then found it necessary to wet the coal before use. Therefore, he let the coal come through as usual and dealt with the moisture in the furnaces. Water in Burton-on-Trent had 26 to 80 deg. of hardness; he now used an evaporative plant to reduce the hardness, but found, through the assistance of a chemist, that ammonia was present, the first sign of which was that there was a red deposit instead of the usual white sulphate. This ammonia came from the breweries' effluent.

Mr. J. R. P. LUNN (Darlington) said he had adopted a method of taking coal samples which had proved very satisfactory in that the colliery companies accepted the results. He took a cone-shaped receptacle, 4 or 5 inches at the top and 8 or 9 inches at the bottom, and hung this under the truck. This receptacle held about 20 lb., and the quantity of coal so obtained was put into a Sturtevant sampler, which was arranged so that about 5 per cent. of the coal put through it was delivered into a separate receptacle. This amount was placed in an air-tight tin, and similar samples were taken from all the trucks of that particular consignment. These 5 per cent. samples were then taken to the laboratory and analysed. This method had been in use for eight or nine years.

Mr. S. E. FEDDEN (Sheffield) said his department had increased its plant efficiency by 10 to 15 per cent. since Mr. Miles was engaged. So far as small stations were concerned, he suggested that the I.M.E.A. should collect figures of calorific values of coals from such stations as could send them in, in order that these figures might be a guide to the smaller stations which could not afford to employ a chemist. To get over the trouble of large coal segregating at the sides of the hopper, he had fitted thin bars to the centres of the chain grate stokers and thus obtained more uniform burning. With a view to avoiding trouble with the arches he had had some bricks built of the expensive siluminite clay from India which had been used for the top of electric furnaces, to see if they were better than carborundum. He did not think it mattered how much one paid for firebrick if it could only be got to stand the high temperatures required nowadays. A special instance of the value of a chemist in the works had been seen at Sheffield. Something like 200,000 gallons of insulating oil was used per annum, and plant for purifying that oil had been installed. The sludge was removed—and, incidentally, used for putting round ordinary street boxes—and the oil rendered suitable for use again at a cost of 3d. to 4d. per gallon, whereas it cost formerly 3s. 6d. per gallon to replace the used oil with new oil. This plant had completely paid for itself in four months and several times over since then. So satisfied were the colliery companies around Sheffield with the system of testing coal adopted there that they now asked the department to carry out tests for them privately.

Councillor J. W. COLLINS (Birkenhead) said he had come specially to hear this paper, and would go back and recommend that a chemist should be engaged by his committee.

The author's reply will appear in the I.M.E.A. Proceedings.

A Gargantuan Electric Sign.—According to *Electrical Merchandising* the mountains in the neighbourhood of Hollywood, the centre of the American film-production industry, have been "adorned" with the largest electrical sign ever constructed. This enormous erection consists of the word "Hollywoodland" in letters 45 ft. high, the whole being about a quarter of a mile in length. Our contemporary states that four thousand lamps are used. As from the photographs reproduced with the note we judge that the lamps must actually be in the face of the sign, even this number would appear to be very inadequate for the purpose unless they are of great power.

Flueless Gas-heating Stoves.—A joint committee of representatives of the Society of Medical Officers of Health and the Royal Sanitary Institute has been considering the use of gas stoves for domestic and workshop heating where no provision is made for the escape of flue gases to the outer air. The report of the committee has just been issued, and a summary of the conclusions arrived at is as follows: "So convinced are the committee of the absolute necessity of a very free ventilation existing where flueless gas stoves are in use that—bearing in mind the usual absence of this free and effective ventilation in living rooms, bedrooms, workrooms, &c.—they think it desirable to discourage the introduction of these stoves and to express the opinion that their use can only be justified in such places as entrance halls, passages, landings, &c., where ventilation is free and where the occupants do not remain for any considerable length of time. In support of this conclusion it may be noted that for more than 30 years it has been one of the rules of the Royal Sanitary Institute that no stove in which heat is produced by combustion of gas, coke, or charcoal may be admitted to the exhibitions of the Institute unless it is designed for use with a flue."—*Gas World.*

The Perfect Estimator.

By T. J. B.

ESTIMATING is usually considered to be a rather monotonous non-technical job, which may be satisfactorily handled by an intelligent lad who has served his time in the cost office and has attended evening classes. Only an experienced estimator can appreciate the many qualities and the wide experience which the work demands, and some thoughts on the subject may be of interest.

As a basis, it may be assumed that an estimator must have a complete practical and theoretical knowledge of his branch of the industry, including workshop and drawing-office practice, test-room and erection experience, and a general outline of the latest advances, improvements, and inventions up to, say, a year ahead. Add a familiarity with the price of every possible commodity, and some rudiments of high finance and the policy of "The Management," and our estimator may be considered fit to embark on his career and handle small jobs under close supervision.

In time he will learn to be a thought reader, able to read between the lines of every inquiry and deduce from some remark about terms of payment the fact that the prospective customer wants the quotation to include all pipe work, a new cooling tower, and a rack of spanners. The omission of information regarding voltage and system will not cause our estimator any embarrassment—he will find all this in a list of supply undertakings, and state in the quotation that the supply is 6,600 volts, 3-phase, 50 periods, neutral earthed, when all the customer knows is the price per unit.

If our mythical friend deals with erection work, he will naturally know all about the conditions on site, will be aware that there is rock beneath a foot of sand, no road within a mile, a blacksmith in the village who can do simple welding work and can tell the erector a good place to put up at. When his chief shows him two cost cards for identical stock items, differing in cost by 50 per cent., he will at once explain that the man who makes these things had missed a winner by a short head on the day he made the last lot, and was naturally not able to put his back into the work. In calculating delivery dates instinct will tell him what stocks will be low when the order goes through, how long it will take to get special material from Tomsk (branch line from Omsk—trains during summer only), and when the next strike is due.

A smattering of modern languages will enable him to understand that "an interrupter in a bath of oil with detachers automatic" is a brutally literal translation meaning an automatic oil switch.

Discretion and common sense are necessary when dealing with a request to provide "everything necessary for the safe and economical working of the plant." It is not usual to supply a staff of trained engineers, although this may really be essential for safe working.

Our estimator will have a fairly accurate idea of the climate of every town in the world, the class of labour available, c.i.f. rates to the nearest port, and the local "Home Office" rules.

It is hardly necessary to mention that a command of reasonably correct and clear English is essential; flowery rhetoric is out of place in a specification, and so are faulty construction and obvious grammatical errors.

The most valuable part of our estimator's equipment will be his memory. Tucked away in his brain will be facts concerning customers' likes and dislikes, a short list of their orders, how one firm will pay a good price for a first-class job—but it must be first class—how another firm doesn't worry about finish if the price is reasonable and the plant runs all right, and so on.

The above by no means exhausts the list of desirable virtues, but it will be realised that a man who has all these attributes deserves a good salary and a better title than that of "estimator." "Inquiry engineer" is probably a better term, and indeed he should be an engineer, handling jobs from the inquiry stage to completion of erection, in which case he becomes a contract engineer.

One of the best arrangements is for men to work in pairs, the senior to plan out the installation, interview customers, and supervise the whole job, the junior doing the actual routine figure work of estimating and dictating less important tenders. The senior will be able to handle orders and important tenders without being overworked, as the number of inquiries which do not mature will keep his assistant busy. By this plan every job has individual attention, and a responsible man can be employed capable of taking entire charge of the work, consulting on matters of policy only the manager of his department, who will thereby be relieved of a lot of worrying supervision. Incidentally, estimating will become less of a blind-alley occupation.

An Improved Overload Time-limit Relay.

SOME two years ago an improved form of overload time-limit relay was devised by the Swedish General Electric, Ltd., and after numerous tests under different working conditions over lengthy periods this apparatus has within the last few months become available for commercial use.

Generally the standard relay is built single-pole: it is of the induction type and intended for use in conjunction with current transformers. The time lag can be adjusted from 2 to 20 seconds, whilst the current setting can be adjusted from 80 per cent. of normal load to twice full load. The actual working parts may be considered under two headings:—(1) The driving device with current-setting attachment, and (2) the release mechanism with time-setting attachment.

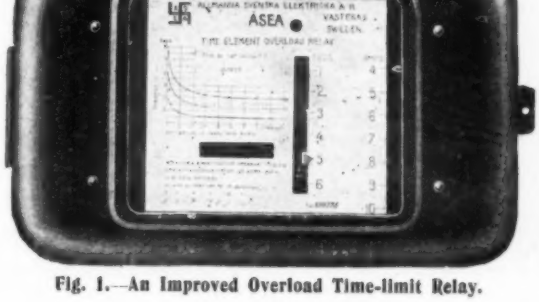


Fig. 1.—An Improved Overload Time-limit Relay.

Fig. 1 indicates the apparatus in its finished form, the whole relay being closed in a light metal casing with a large window in the front, showing exactly the time and current settings with characteristic curves on the dial for the attendant's guidance.

The driving device consists of an aluminium disk which is caused to rotate on the induction principle by the combined influence of a stationary electromagnet and an auxiliary field displaced from it and with a permanent magnet to act as a damper. The spindle to which the disk is attached is carried by a fork-shaped bracket and normally the disk runs idle, disconnected from the operating or releasing mechanism. Rotation of the disk commences with a very small current (10 per cent. of the value set) passing through the coil winding, and this is an advantage, as it is possible to observe through the window that the relay is in working order.

The operating coil is fed from a standard current transformer, which at full load would have a normal secondary current of 5 A. This coil is provided with tappings, enabling the relay to be set for different current values. The tappings are arranged in such a manner that the number of active turns is inversely proportional to the release current, thus the ampere-turns are constant at all current settings. As a result the time calibration curves are always of the same shape and allow an unusually large and exact variation of the release current.

To vary the current setting a small plug is inserted in whichever opening is desired in the multiple contact piece provided on the right hand side of the relay. The point of the plug projects beyond the contact piece and comes opposite the particular current marking for which the instrument is set. The minimum current setting is 4 A and the maximum 10. The releasing mechanism consists of a toothed sector

operating a moving arm placed on top of the electromagnet. When a current passes exceeding that for which the relay is set, the torque on the aluminium disk increases, and in addition to the rotary motion of this disk the latter is displaced to a small extent horizontally, thus allowing the worm wheel

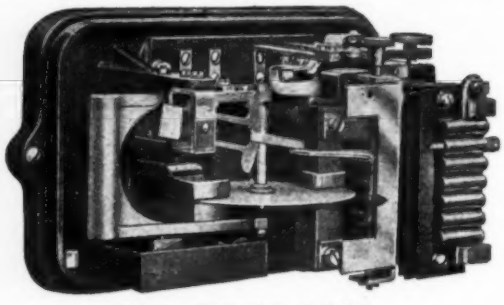


Fig. 2.—Mechanism of Relay.

on the disk spindle to engage with the toothed sector referred to above. With the continued rotation of the disk the toothed sector rises, as a result of which the relay contact is operated, thus causing the switch or other device to trip. Each relay is provided with a standard bracket-shaped fitting, which can be turned upside down, whereby the relay contact can be arranged for opening or closing the circuit, whichever is desired.

With this form of relay "floating" is impossible. If the overload ceases before the relay contacts close, the current has only to sink to 85 per cent. of the value set on the scale to bring the whole mechanism instantly back to its original position. To alter the time setting an adjusting screw is provided by means of which the lower position of the toothed sector can be adjusted, thus varying the time taken to raise it to the release armature. Apart from the usual setting for time and current, an auxiliary device is provided whereby the relay gives instantaneous release if the current exceeds 4, 6, or 8 times the normal current setting. This is done by means of a milled screw governing the position of the auxiliary moving part of the magnetic circuit.

Tests carried out with a number of these relays in circuit set for varying times with the same release current, showed that their operation was so perfect that the relays could be made to trip in succession for any pre-determined time.

The power consumption for the standard inverse time relay on a 50-cycle circuit is only about 8 volt-amperes, so that in most cases these relays can be connected to transformers feeding current and power measuring instruments without causing any appreciable error.

The Empire Mining and Metallurgical Congress.

The Wembley Exhibition Meetings.

(*Concluded from page 1024.*)

Mechanical Coal Mining.

"This subject," states Mr. Sam Mavor, "means not merely the application of a coal cutter or a face conveyor; it implies a co-ordinated system whereof the use of coal-face machinery is a part and may be defined as the application of coal-face machinery in systematic conformity with a predetermined mining policy." In his paper the author reviews past progress, states the present position, and indicates future prospects.

In Scotland, where economic pressure has been most severe, the present position is that 40 per cent. of the total output is already mined by machinery, and the proportion is rapidly increasing; many thin seams which could not be commercially worked by hand are being mined by machines, and a valuable national asset is thus saved; at many of the collieries whose existence is entirely dependent on systematically organised machine-mining the proportion is 100 per cent., and all recent collieries have been planned on the basis of the whole output being cut by machines. In England and Wales the position is that only 11.2 per cent. of the output is machine-mined; in no other district does the proportion exceed 21 per cent.

The distribution of men over large underground areas and the attendant difficulties of communication, and therefore also of co-ordination, lead unavoidably to much loss of time the most costly factor in production. Moreover, the output per man is governed largely by the inclination of the individual miner, whereas with intensive mining the men no longer work in isolation, but are grouped and all must share in the general activity on which depends punctual completion of the work allotted to the shift. Intensive mining thus transfers to the management the responsibility of obtaining the best production from a given expenditure of human effort, and brings under control the expenditure of time.

Selection of the type of coal-cutter is a large subject. The sphere of the disk coal-cutter is restricted to longwall working, and its special character is its capability to cut the hardest cuttable materials; where the conditions are favourable to its use the machine will give service that cannot be equalled by any other type, and will cut faster, farther, and with lower cost of maintenance; it is the most powerful and strongest of coal-cutters, and the largest electrically-driven machines of this type are capable of giving from 80 to 100 h.p. for short periods. The chain coal-cutter, which in recent years has earned rapidly increasing favour, occupies an intermediate place. The bar machine is the most versatile, and there are many conditions in which it is completely successful where both the other types fail.

The capacity of modern heading-machines for rapidly and economically advancing coal-headings has far-reaching influence on plans of seam development. Narrow places can now be driven in coal rapidly and yield an output that enables the headings to pay their way.

Of the many types of face conveyors, those that have survived the ordeal of service conditions are mostly of the continuously discharging (1) shaker, (2) scraper-chain, and (3) textile band types. The first-named is the simplest and the least expensive in first cost and in maintenance.

A valuable adjunct to the face-conveyor is the gate-end loader, which provides continuous loading of trams in arrear where the men are safer and their freedom of movement is less impeded by timber.

Where intensive mining is practised, considerable numbers of men are grouped on comparatively short lengths of face. This condition opens the way to illumination of the working-faces, and renders flood-lighting not only technically feasible, but economically advantageous; for adequate lighting is a condition of development of the full advantage of mechanical appliances.

Illumination of the conveyor-faces from end to end is already an accomplished fact in open-lamp pits. Wherever the use of electric light at the face is permissible, there is no reason why the movements and operations of the men should be restricted by lack of light and by the necessity for attending to their individual lamps.

The method of lighting conveyor-faces is the use of a small transformer in one phase of a three-phase circuit, for the supply of thirty 25-volt 25-c.p. gasfilled lamps, spaced at intervals of 12 ft. along the face, and as required at the loading position and at the conveyor motor. It is probable that the same advantages will soon be available at conveyor-faces in gaseous mines. Another method of making powerful electric light available in safety-lamp pits is an ingenious device which embodies in a portable lantern a small compressed-air turbine coupled to an electric generator for supplying a lamp of 20 or 30 or more candle-power; there are no wires external to the lantern, and it is an essential condition of working that the chambers containing the lamp and the electric parts shall be filled with pure air at a pressure above that of the mine.

Inadequacy of transport facilities is the rock on which ambitious schemes of face-conveying have not infrequently been wrecked. The following table gives the ascertained results of working by four methods the same seam, 2¾ to 3 ft. thick, at the same colliery, under the same physical conditions, under the same management, and by the same kind of men:—

Method of working.	Length of face.	Output per day.	Total No. of men.	Output per man per shift to haulage.
	Yards.	Tons.		Tons.
(1) Hand-pick	75	60	18	3.30
(2) Coal-cutting and hand-tramming	105	135	28	4.82
(3) Coal-cutting and face-conveying (single unit)	90	120	21	5.71
(4) Coal-cutting, face-conveying, gate-end loading (single unit) ...	90	130	20	6.50

The multifarious duties of the colliery manager make it impossible for him to acquire and apply expert knowledge in every department; he must necessarily rely on subordinates skilled in their several specialities. It is submitted that the technical staff usually at the disposal of the manager is not sufficient in number or adequate in training for the task of organising and maintaining such a relative standard of efficiency in production as is now common in other important industries.

Tin Mining in Malaya.

In his paper on the above subject Mr. L. G. Attenborough shows that in 1923 the British Empire's production rose to 40.5 per cent. of the world's total of 125,800 tons, and that of Malaya to 31.5 per cent. This increase is entirely accounted for by the increased amount of tin won by dredges in 1923.

Various types of motive power are in use, the most common being an ordinary portable steam-engine giving from 50 to 70 b.h.p. A large number of superheated steam-engines are also used as well as semi-Diesel oil engines; the latter are found to be economical, and there are also a certain number of pumps driven by electrical power, purchased from a European company. There are 230 sets of plant of this kind in use in the Federated Malay States, of which over 160 are working in the Kinta Valley alone. The Gopeng Consolidated, Ltd., and Kinta Tin Mines, Ltd., are proposing to establish a hydro-electric plant and will then in the deeper portion of their ground use electrically-driven gravel-pumps instead of hydraulic elevators. This will give a much greater overall efficiency, as a portion at least of the water used for the elevators will be available for the monitors. Another interesting mine is that of the French Tekka Co., which was the first to introduce the system of catching the water employed at as high an elevation as possible, and establishing a hydro-electric station above the intake of the pipeline. The power so developed is transmitted to the mine and there used to drive gravel-pumps, while the water is used for monitors. This company has lately installed a new electric power station about 800 ft. above the intake of the old power station, capable of generating 2,300 h.p.; in addition to the 1,000 h.p. generated in the old power-station. The new power is to be used on outlying property and the excess will be sold to Chinese gravel-pump mines. Another mine which has also adopted this principle of developing power by water prior to using it for monitors is the Irdis mine, at Kampar.

It is unlikely that any great extensions of this form of mining will be made, as practically all the available water supplies which give a satisfactory head have been taken up. The question of fuel supply has become most serious. If a company is operating four or five dredges there would be probably a considerable economy if the power were distributed electrically from one central turbo-electric station, but the extra capital does not justify this whe there are only one or two dredges. In these cases probably the most economical proposition at present is to install an internal-combustion engine of, say, from 350 to 400 h.p. on the dredge, and transmit power by direct current to the various points where it is required.

Shortly after the war the Government went into the question of establishing a large low-head hydro-electric scheme on the Perak River, some 30 miles from Ipoh, and distributing power to the mines. Owing to subsequent financial stringency this matter was dropped, but Messrs. Armstrong, Whitworth and Co. are now, with Government approval, going into this question.

The Rhymney Compressed-air Installation.

The installation described by Mr. E. L. Hann serves a group of 11 collieries of the Powell Duffryn Steam Coal Co., Ltd., and the Rhymney Iron Co., Ltd., in the Rhymney Valley. It should be mentioned that the underground conditions in the steam-coal measures of the South Wales coalfield, owing to the large amount of fire-damp given off and the difficulty of keeping satisfactory roads open, due to the tender nature of the roof and floor, do not lend themselves to the extensive use of electricity at considerable distances from the shafts, and that in general, beyond the main haulages and main pumps situated near the pit-bottom, all power used in-bye is provided by compressed air.

In 1919 the estimated quantity of compressed air required during the coal-winding shift was about 100,000 cu. ft. per minute, but the capacity of the existing compressors had become inadequate.

The decision was to put down central generating plant, utilising of the existing plant only the electrically-driven compressors and adding one or more electrically-driven compressors at the far ends of the mains. A central electric station to have a capacity of 30,000 kilowatts, with steam conditions of 350 lb. per sq. in. and 750 deg. F. temperature, was in course of construction at Bargoed, so that it appeared to be an obvious step to extend this station by the installation of the necessary turbo-compressors. A full description of this station was included in a paper the author contributed to the South Wales Institute of Engineers.

Variable-speed motors were found unnecessary, and for power-factor improvement it was desired to use salient-pole synchronous motors, but the general impression of the manufacturers was that this type of motor had not sufficient starting torque to run the compressors up to speed; experiments were therefore carried out which showed that the starting torque need not exceed 33 per cent. of the full load torque; having proved satisfactory, this type of motor has been standardised. The advantages over the ordinary synchronous induction-motor are: higher efficiency, larger air-gap (the latter enabling the motor to be safely direct-coupled to the compressor flywheel), and a greater range of power-factor control. The efficiency of the latest motors is 95.7 per cent. at unity power-factor, thus reducing the consumption per 1,000 cu. ft. of air from 133 to 129 kilowatts. The light-load losses are also lower. Tables I and II show the comparisons of the capital costs and efficiencies for generating and transmitting 1,000 cu. ft. of air various distances by: (1) transmitting electricity to a point at which the compressed air would be used, and there using a motor-driven compressor; (2) generating by steam-driven turbo-compressor and transmitting the air by pipe-lines, the size of the air-mains chosen being such as to give approximately equal energy losses to those experienced in electrical transmission.

TABLE I.—TOTAL COSTS.

Distance, in miles	1	3	5
	£	£	£
Electrical transmission ...	56,200	62,600	69,000
Air transmission	32,000	40,500	49,000

TABLE II.—ENERGY LOSSES PER CENT.

Electrical transmission ...	1.8	3.2	4.6
Air-transmission	0.85	2.5	4.2

The Metallurgy of Special Steels.

In a paper on the above subject, Dr. W. H. Hatfield (of the Brown-Firth Research Laboratories) deals with developments under three headings: (*a*) Improvement in the processes of manufacture and manipulation resulting in increased reliability; (*b*) modified and new compositions resulting in improved or new properties; and (*c*) a more intimate knowledge of the properties of the steel from the designer's standpoint.

The production of more reliable and effective permanent magnets has been a necessity of recent years, and it can be said that the metallurgical investigator has tackled that problem with considerable success. The influence of the various items of the process of manufacture in producing variable results in the final magnet has been thoroughly explored, with the result, for instance, that the ordinary tungsten magnet can now be guaranteed to give a coercive force of from 60 to 65, accompanied by a remanence of from 10,000 to 11,000. A great advance in our knowledge and in the properties of magnet steel has resulted from the work of Prof. Honda, who has found that by the addition of from 30 to 35 per cent. of cobalt a coercive force not under 200 may be accompanied by a remanence of 10,000. It will thus be seen that, in this field, particularly, metallurgical developments place something of very real value in the hands of the electrical engineer.

The Sullivan Mine Cottrell Plant.

In their paper Messrs. W. M. Archibald, E. G. Montgomery, E. M. Stiles, R. W. Diamond, B. A. Stimmel, J. Buchanan, G. E. Murray, J. J. Fingand, and S. G. Blaylock outline the history of the Sullivan Mine, now owned and operated by the Consolidated Mining & Smelting Co. of Canada, Ltd.; give an account of the various methods by which the ore has been treated; and finally outline the present mining and metallurgical practice, along with a description of the plant at Kimberley and Tadanac. Electric battery locomotives are used, and such machines as fans, air compressors, "mucking" plant, crushing rolls, pumps, travelling cranes, &c., are all electrically driven, and a 600-ton magnetic concentrator was built, but was later abandoned in favour of the flotation process. Three-phase, 60-cycle power from the East Kootenay Power Co.'s plant at Bull River is transmitted at 60,000 volts, and transformed to 550 volts in a sub-station adjacent to the mill. From eight 800-ampere panels cables feed through a distributing tunnel the individual starting panels. Nearly all machines have individual motors, most of which are direct-connected through flexible couplings. A large number of spur-geared speed-reduction units are employed. There are 160 motors in use, varying from 1 to 200 h.p. The installed h.p. is 739; operating h.p., 509.

The electrolytic plant was constructed in 1915, and has shown that it is able to produce zinc more cheaply than the retort method. It is also able to handle more complex material of a lower grade.

The roasters have a common flue that leads to a 16-section Cottrell plant, constructed on the plan of those connected to the D. & L. plants at the lead-smelter, referred to later. This treater, however, is operated on the down-draught principle. Two 25-kVA rectifier sets supply the power for this plant.

The Trail method of leaching, which calls for a double-circuit continuous counter-current leach, has proved to be an important factor in the efficiency and cost of this part of the process. There are two distinct leaching circuits, the "acid" and the "neutral." The purified solution from the leaching plant is treated by electrolysis, the zinc being deposited on aluminium cathodes. One electrolytic building contains 12 electrolytic units and the other 14. Each unit consists of 18 double-cell tanks. The arrangement of lugs and bus-bars is unique, and has given very good service. It uses a minimum amount of copper, and the current leakage is small. The anodes are welded to the lead-covered copper bus-bars, and the copper cathode lugs are split so as to allow them to act as a spring when forced down into a slot in the copper bus. This system allows the anodes from each cell to be lifted as a unit for cleaning. The average ampere-hour efficiency is from 90 to 95 per cent. The current density used is from 26 to 27 amperes per sq. ft., and the voltage-drop across each cell is about 3.5 volts. The power is supplied by motor-generator sets, each consisting of one 1,150-kVA synchronous motor and two 500-kW generators. A generator is placed on each side of the motor, and each generator supplies power for one battery of 36 cells.

Three separate sets of Cottrell plant are in use for handling lead-bearing gases. The oldest was the first commercial installation of its kind in connection with the lead-smelting industry, and is used for cleaning the gases from the lead blast-furnaces. The other treaters are attached to the sinter-

ing plant. It is not only necessary to control the velocity of the particles through the pipes, but also to have a conductive deposit. The general method of obtaining this has been to humidify the gas by water sprayed under pressure, which has brought in its train a number of new problems, some of which have yet to be solved in a satisfactory manner.

The refinery operations comprise: (1) Electrolytic separation of pure lead from lead bullion by the Betts process; (2) electrolytic separation of copper from copper bullion; (3) the furnace treatments whereby the gold and silver contents of the anode sludges from both electrolytic processes are converted into Doré metal; and (4) the parting plant where the gold and silver are finally separated one from the other.

The Trail electrolytic-lead refinery was the first to operate on the Betts process developed at Trail. The anodes, weighing about 360 lb., have a life of eight days, during which time two crops of cathodes are withdrawn. The voltage drop between electrodes varies from .23 to .5 volt. The electrolyte used contains 11 per cent. to 13 per cent. total H_2SiF_6, and from 6 per cent. to 9 per cent. lead. No purification of the electrolyte is required.

Power for the Tadanac plant is obtained from a subsidiary company, the West Kootenay Power & Light Co., at Bonnington Falls, some 30 miles away on the Kootenay River. Two lines at 60,000 and two at 20,000 volts deliver power to a central sub-station. Here it is transformed to 2,200 volts and distributed to departmental sub-stations, where it is again stepped down to 550 volts, which is standard throughout the plant, except in the zinc plant, refinery generator rooms and rod mill, where 2,200 volts is used. The total power consumed for the present operations is about 14,000,000 kWh per month.

New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

The "Liberty" Crystal Set.

The outstanding feature of the "Liberty" crystal receiving set (fig. 1), which is being put on the market by the HAYWARD TURBINE ENGINEERING, LTD., Liberty Works, Acton Town Station, W.3, is that it can lie flat wherever it is placed and is therefore not liable to be overturned. The apparatus is mounted in a circular stamped sheet case approximately 6 in. diameter and 2 in. deep, highly finished in black enamel, with nickel-plated terminals and metal parts. The tuner is a

Fig. 1.—The "Liberty" Crystal Set.

variometer of special design. Between the aerial and earth terminals a third terminal is fitted enabling the set to be used on either long or short aerials, or long or short wave lengths within the broadcasting range. The type of crystal detector used is arranged for easy replacement of the crystal. The set can be provided with a hook for hanging it on the wall with another at the bottom for the accommodation of a pair of head 'phones.

A New Sterling Radio Receiver.

As will be seen from fig. 2 the new combined four-valve receiver and loud speaker made by the STERLING TELEPHONE AND ELECTRIC CO., LTD., 210-212, Tottenham Court Road, W.1, is built into a distinctive cabinet of high artistic merit. The set incorporated is the well-known Sterling 4-valve, comprising one stage of high-frequency amplification, a detector, and two stages of low-frequency magnification, the last of which is effected by means of a "power" valve coupled by means of a Sterling "power" transformer.

With a good aerial most of the British broadcasting stations can be received on this set at a strength sufficient to operate the specially designed loud speaker built into the cabinet, which reproduces with great fidelity. As a consequence of distortionless magnification in the set and pure reproduction by the loud speaker, the results given by this combination are particularly good.

Fig. 2.—A New 4-Valve "Sterling" Radio Receiver.

Normally arranged for receiving British broadcasting, the set can be quickly adapted for wave-lengths up to 3,000 metres. This is effected by sliding out the panel from the front, whereupon coils can be added and the appropriate reaction units substituted. In this way, too, adjustments to the loud speaker can easily be made.

A New Cigar Lighter.

The SALES COMPANY OF AMERICA, 420, Turk Street, San Francisco, Cal., has sent us particulars of the "Litit" cigar lighter, which it has recently put on the market. This, as will

Fig. 3.—The "Litit" Cigar Lighter.

be seen from the illustration (fig. 3), consists of a circular back-plate and guard mounted on a well-finished base. The element is of the quartz-tube type, about 1½ in. in length, and loaded to the equivalent of 40-W. The device is apparently made to be on circuit for long periods as there is no switching arrangement upon the lighter itself.

Iron Boxes for Surface Mounting.

Fig. 4 illustrates one of a series of new boxes which have been produced by MESSRS. J. H. TUCKER & CO., LTD., Tyseley, Birmingham, for the accommodation of two tumbler switches and for surface mounting.

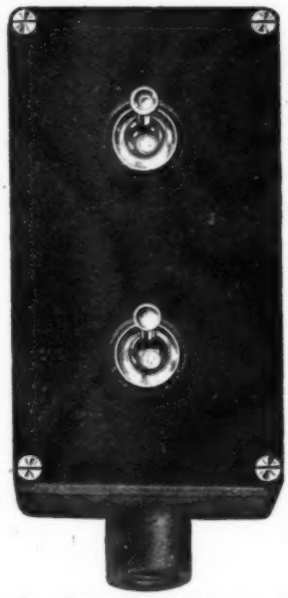


Fig. 4.—Iron Switch Box for Surface Mounting.

The box is provided with a spout entry boss of ample length for the conduit, giving at least six complete threads, this boss being placed as near the back as possible to obviate the necessity of "springing" out the conduit to allow it to enter the box. The end of the boss where it passes into the box is bell-mouthed to avoid chafing the cable. The box is so designed as to give ample wiring room all round the switches. The back of the box is drilled and tapped with screw holes both ways to take new pattern sunk switches on small bases for mounting either horizontally or vertically. The switches are pitched at 2¼-in. centres. The box is at present provided with only one conduit hole.

"Fluxite" Used for Tempering and Hardening.

FLUXITE, LTD., Bevington Street, Bermondsey, S.E.16, the proprietors of the well-known soldering medium, draw our attention to a new use for this article, *viz.*, its employment in case-hardening, hardening, and tempering. The method adopted for case-hardening is as follows:—A length of wire is attached to the article to be treated, so that it can be readily placed in and taken out of the fire. It is then smeared all over with a thick coating of "Fluxite," and powdered completely with finely crushed yellow prussiate of potash (potassium ferrocyanide). As much as possible of the latter is made to adhere, and it can be daubed on with an old knife. The article is then placed in a bright fire, and when brightly red-hot it is plunged immediately into cold water.

This produces a clean, bright, glass-hard surface, which goes deeper and is better in every way than the patchy, uneven and scaled job arrived at by the old and inconvenient method of rolling the hot metal in dry potash. The "Fluxite," besides acting as a flux, keeps the potash where it is wanted and fuses it on free from scale. If a still thicker skin of hardening is required, the article can be treated in the same manner several times. For hardening and tempering tools and other steel articles, the practice is as follows:—After the cutting edge has been polished in the usual manner, the steel is thickly smeared with "Fluxite," and then heated to redness and quenched in water. It comes out of the bath free from scale, and will still be bright enough to enable the colours to be seen when reheating to draw the temper. If the steel is heated without the "Fluxite," it has to be ground to remove the scale before tempering. It is most important that the steel should not be overheated. In hardening tools with a fine edge, such as engineers' screw taps and dies, the "Fluxite" tends to protect the edge from being burnt and scaled.

Exports and Imports of Electrical Goods and Machinery in May, 1924.

THE values of British electrical exports for May reached £1,330,573, an increase of £18,640 on the previous month, the principal increases being recorded in the sections for insulated wires and cables (£38,540 increase), electrical machinery (£37,424 increase), and batteries and accumulators (£17,950 increase); a falling off, however, is recorded in telegraph and telephone cable and material exports of £76,674. As compared with May, 1923, the total is £271,098 higher, principally due to an increase of £116,000 in electrical machinery and one of £61,000 in insulated wires and cables, nearly all other sections showing marked improvement.

Electrical imports for the month increased by £62,489 as compared with April, electrical machinery (£25,616 increase), and unenumerated electrical goods and apparatus (£15,387 increase), being the sections with the largest advances; the total was £77,043 in excess of May, 1923.

Re-exports of Foreign and Colonial electrical goods and machinery at £25,371 were £4,353 in excess of April and £7,817 more than in May last year.

	Exports.			Imports.			Re-Exports.		
	Electrical exports for May, 1924.	Inc. or dec. as compared with Apl., 1924.	Inc. or dec. as compared with May, 1923.	Electrical imports for May, 1924.	Inc. or dec. as compared with Apl., 1924.	Inc. or dec. as compared with May, 1923.	Electrical re-exports for May, 1924.	Inc. or dec. as compared with Apl., 1924.	Inc. or dec. as compared with May 1923.
Electrical goods and apparatus (unenumerated)	£165,484	— £4,236	+ £39,012	£82,318	+ £15,387	+ £7,387	£7,611	+ £4,125	+ £2,897
Insulated wires and cables ...	226,632	+ 38,540	+ 61,041	40,355	+ 9,823	+ 23,570	858	+ 492	+ 821
Glow lamps	26,520	— 1,800	+ 168	7,856	— 3,757	— 2,925	584	+ 532	— 185
Arc lamps and parts	706	+ 377	+ 13	1,844	— 1,469	+ 14	43	+ 43	+ 43
Batteries and accumulators ...	68,918	+ 17,950	+ 25,077	15,323	— 4,770	+ 2,067	300	+ 273	+ 278
Meters and instruments ...	47,454	+ 6,728	+ 15,504	19,488	+ 2,299	+ 13,049	882	+ 794	+ 112
Carbons	2,014	— 849	— 1,988	20,146	+ 8,102	+ 9,973	33	— 1,022	— 648
Electrical Machinery—									
Electrical machinery (unenumerated)	241,909	+ 54,479	+ 116,736	117,768	+ 25,616	+ 38,135	10,196	— 1,391	+ 758
Railway and tramway motors	23,264	— 3,935	— 10,869	—	—	—	—	—	—
Other motors and generators ...	192,153	— 13,751	+ 9,308	—	—	—	—	—	—
Switchboards (not telegraph or telephone)	5,804	+ 631	— 1,645	13	+ 6	+ 13	25	— 881	+ 25
Telegraph and Telephone Cable and Material—									
Telegraph and telephone wires and cable (not submarine)	109,411	— 10,514	+ 24,518	11,381	— 560	— 3,060	70	— 314	+ 70
Submarine telegraph and telephone cable	26,832	— 21,742	— 13,972	—	—	—	—	—	—
Telegraph and telephone instruments and apparatus ...	193,472	— 43,418	+ 11,195	63,978	+ 8,874	— 11,179	4,737	+ 1,715	+ 3,636
Totals...	£1,330,573	+ £18,460	+ £271,098	£380,970	+ £62,489	+ £77,044	£25,371	+ £4,353	+ £7,807
Increase or decrease for the five months ended May, 1924 ...		Exports. + £1,065,770			Imports. + £213,281			Re-exports. + £20,781	

A Large Private Automatic Telephone Exchange.

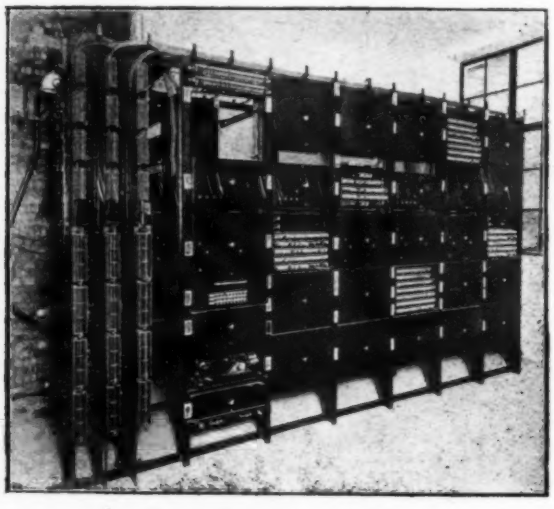
The Britannic House "Relay" Installation.

AT Britannic House in the City, the newly-erected steel-frame building of ten storeys, designed by Sir Edwin Lutyens, and built for the Anglo-Persian Oil Co., there has recently been brought into service the largest private automatic telephone exchange yet erected in England. The installation is of the "Relay" type, but is a new departure in respect of arrangement and voltage.

The "Relay" switchboard and batteries, together with the P.O. manual switchboard, are housed in a large room in the upper basement floor, the charging panel and generator being in the lower basement. The equipment is arranged for 240 lines, which have been already allocated, with an ultimate capacity of 400. The framework, which is 8 ft. 9in. high, is divided into two racks, No. 1 having six, and No. 2, two bays all fully equipped. The main and intermediate distributing frames are of the combined type, comprising three verticals of framework.

The planning of the groups, &c., is of quite novel character. Bay A contains the ringing machine with its accompanying groups, a marker group for 300 lines, a key and marker lamp group, two fuse panels, a recorder group, and a feed and connecting group containing trunk connecting relays, and two ringing units. Bays B, C, and D, each contain one recorder group, a feed and connecting group, and three groups of 10 "subs" each. Bays E and F contain a feed and connecting group and four groups of ten "subs" each. The two bays on Rack No. 2 are identical with Bays E and F. Bays E and F are the standard equipment for subsequent additional bays, which each carry the equipment for 40 subscribers and their necessary feed and connecting group.

The run of the switchboard cables is also a distinct departure from usual standard practice, one set being midway across the racks just above the feed and connecting groups and providing for commoning the "in trunks," recorder connections, "busy back," "number unobtainable," tone, and ringing current, 16 trunks being provided initially on the squared principle, the ultimate being 32. The power plant consists of a d.c. motor-generator driven direct from the supply company's mains and having an output of 20 A. The panel is designed on P.O. lines, but has in addition to the usual switches a circuit breaker which releases on overload or reverse current. Each battery consists of 16 cells of 76 Ah capacity. The wiring of the huge building was a considerable



The "Relay" Switchboard at Britannic House.

task in itself, consisting as it does of six 100-pair paper-core, lead-covered cables supported by iron racks and tailed off at the switchboard end with silk and cotton covered cables and at the other ends with twelve 50-pair silk- and cotton-covered cables by means of potheads and thence to their respective junction boxes on each floor. The single pair cables are "Maconite" run in concealed conduit. The telephones are of the usual P.O. standard pattern fitted with the "Relay" dial switch.

In conclusion it may be mentioned that the whole of the work, including the testing of the installation, was carried out, in spite of various unexpected and unavoidable interruptions, in a period of eight weeks.

Published Specifications.

Compiled expressly for this journal by Patent Agents.
The name of the applicant's patent agent, if any, will be found on the printed specification.
The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1922.

33,067. "Treating incandescent electric lamps." W. J. Webb. December 4th, 1922. (216,396.)

1923.

2,480. "Electric fuse boxes, and fuses therefor." C. W. Cox. January 27th, 1923. (216,550.)

2,571. "Electric transmission of signals." J. Bethenod. October 4th, 1922. (Patent of addition not granted.) (205,040.)

2,791. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd., and C. Gillings. January 30th, 1923. (Addition to 194,427.) (216,554.)

5,324. "Electrical discharge apparatus." British Thomson-Houston Co., Ltd. (General Electric Co.). February 23rd, 1923. (216,562.)

5,389. "Electrical resistance heating elements and the mode of connecting them to heat-exchanging surfaces and to electric supply conductors." F. S. Cox. February 24th, 1923. (216,564.)

5,575. "Production of electric arcs." G. T. Southgate. March 8th, 1922. (194,687.)

5,843. "Frame aerials." British Thomson-Houston Co., Ltd., and R. C. Clinker. February 28th, 1923. (216,578.)

6,023. "Thermionic vacuum tubes or valves." C. Seymour, H. G. Hughes, and T. E. Goldup. March 1st, 1923. (216,585.)

6,123. "Thermionic valve circuits." P. W. Willans. March 2nd, 1922. (216,589.)

6,136. "Arc lamps for projection." L. Kamm. March 2nd, 1923. (216,590.)

6,141. "Automatic telephone systems." Automatic Telephone Manufacturing Co., Ltd., and R. bowland. March 2nd, 1923. (Addition to 168,367.) (216,591.)

7,220. "Construction of electrical heating element." W. Weekes. March 13th, 1923. (216,604.)

7,526. "Number dials for automatic and semi-automatic telephone systems and the like." Siemens Bros. & Co., Ltd., E. A. Petithory, and F. Baker. March 15th, 1923. (216,608.)

7,601. "Means for controlling the electrical circuit of weighing-scale mechanism." Automatic Scale Co., Ltd., and E. L. Blick. March 16th, 1923. (216,609.)

7,609. "Electric motor-driven apparatus for haulage and other purposes." Mavor & Coulson, Ltd., and A. W. Davies. March 16th, 1923. (216,610.)

8,002. "Renewable electric fuses." British Thomson-Houston Co., Ltd. (General Electric Co.). March 20th, 1923. (216,612.)

8,136. "Overwinding gear for electric cranes." B. E. F. Greenaway. March 22nd, 1923. (216,615.)

8,334. "Manufacture of electrodes from natural graphites." E. Ridoni and Soc. Talco e Grafiti Val Chisone. March 23rd, 1923. (216,617.)

8,586. "Thermally-actuated electric switch." C. French. March 26th, 1923. (216,618.)

8,887. "Trolley poles and standards in overhead wire systems of electric traction." C. W. Merrick. March 28th, 1923. (216,623.)

8,973. "Electric drum-type controllers." Crompton & Co., Ltd., and W. F. Jones. March 29th, 1923. (216,624.)

10,491. "Variable electric resistances for potential control." Igranic Electric Co., Ltd. (Cutler-Hammer Manufacturing Co.). April 17th, 1923. (216,649.)

10,532. "Pad for use with wireless or other head telephones." S. Sheldon. April 18th, 1923. (216,650.)

10,711. "Reception of wireless signals." N. Lea and Radio Communication Co., Ltd. April 19th, 1923. (216,651.)

10,981. "Telephone repeating systems." M. Latour. April 22nd, 1922. (196,626.)

11,210. "Aerials for use in wireless installations." P. Richardson. April 25th, 1923. (216,657.)

11,442. "Galvanic cells." R. Ziegenberg. April 27th, 1923. (216,659.)

12,286. "Chains for suspending electric appliances and for other purposes." G. & J. Swingler, Ltd., and E. Swingler. May 8th, 1923. (216,671.)

13,037. "Electrical resistance units." Ward Leonard Electric Co. August 24th, 1922. (202,958.)

13,667. "Self-regulating arc current electric generators." H. Wade (White Fuel Oil Engineering Corporation). May 23rd, 1923. (216,689.)

13,936. "Electric transforming apparatus." J. E. Calverley and W. E. Highfield. May 26th, 1923. (216,690.)

14,397. "Automatic reclosing circuit-breaker systems." British Thomson-Houston Co., Ltd. June 5th, 1922. (198,683.)

16,750. "Electric irons." K. M. Raymond. June 27th, 1923. (216,713.)

17,727. "Methods and machines for coating cores." Western Electric Co., Ltd. (Western Electric Co., Inc.). July 9th, 1923. (216,724.)

20,679. "Electrically-illuminated sign." S. R. Lines and British Oil and Cake Mills, Ltd. August 14th, 1923. (216,743.)

20,786. "Electric leading-in terminals." E. Pfiffner. August 15th, 1922. (202,641.)

21,285. "Wireless receivers." C. G. Rope. August 22nd, 1923. (216,760.)

22,007. "Electric furnaces or the like, and heating elements therefor." Metropolitan-Vickers Electrical Co., Ltd. (Westinghouse Electric and Manufacturing Co.). August 31st, 1923. (216,756.)

23,266. "Automatic control equipments for electric rotary converters." British Thomson-Houston Co., Ltd. November 29th, 1922. (207,788.)

25,677. "Closed arc lamps." General Electric Co., Ltd. June 23rd, 1923. (216,772.)

25,678. "Tungsten arc lamps." General Electric Co., Ltd. May 4th, 1923. (215,308.)

26,733. "Automatic reclosing circuit-breaker systems." British Thomson-Houston Co., Ltd. (General Electric Co.). October 25th, 1923. (216,783.)

27,148. "Multi-pole electric junction boxes." F. Fay. October 30th, 1923. (216,786.)

27,609. "Three-phase rivet heater." Soc. Anon. Electricité et Electro Mécanique. April 11th, 1923. (214,194.)

27,876. "Apparatus for the electrical precipitation of suspended particles from gaseous fluids." Lodge-Cottrell, Ltd. (Metallbank und Metallurgische Ges. Akt. Ges.). November 6th, 1923. (216,789.)

28,859. "Armature windings for dynamo-electric machines." Metropolitan-Vickers Electrical Co., Ltd. November 23rd, 1922. (207,521.)

31,055. "Electric bell-push, whereby it can be used for the extension of the electric circuit and wireless broadcast." Dr. J. W. Cathles and M. L. Cathles. December 11th, 1923. (216,802.)

31,769. "Electric braking mechanism." H. V. James. December 19th, 1923. (216,807.)

32,556. "Devices for supporting the globes or other forms of shades made use of in electric lighting fixtures." P. C. Egan. February 20th, 1923. (211,839.)

32,580. "Electrical protective systems." Metropolitan-Vickers Electrical Co., Ltd. January 5th, 1923. (209,412.)

1924.

762. "X-ray tubes." Phonix Röntgenrohrenfabriken Akt. Ges. February 16th, 1923. (211,450.)

897. "Machines for the erection of telegraph poles and the like." J. E. Brown and R. Gardner. January 12th, 1924. (216,814.)

7,990. "Incandescent cathode discharge tubes." Naamlooze Vennootschap Philips' Gloeilampenfabriken. March 29th, 1923. (213,605.)

The "ORBIT" *Fan.*

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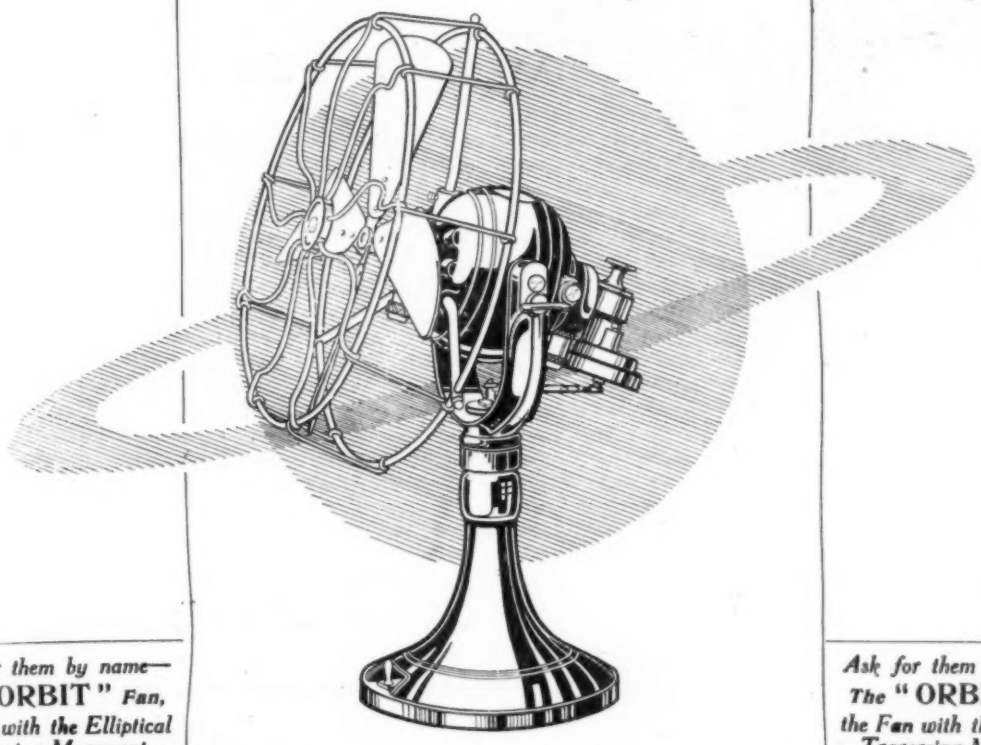

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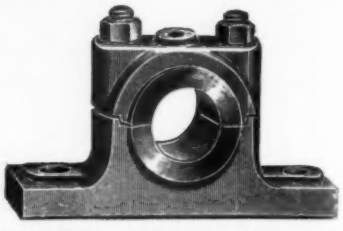

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(As Illustrated).

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Shafting (bright, turned) per ft.	10½d	1/1	1/3	1/6½	1/11
Plummer Blocks, cast iron ...	1/1	1/6	2/1	2/3	3/6
,, ,, brass lined ...	1/7	2/6	3/5	4/6	6/1
,, ,, self-oiling ...	1/9	2/9	3/9	5/-	6/9
Collar, turned steel	1/3	1/6	1/9	2/-	1/3

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BEARINGS, cast iron
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,, ball socket
,, self oiling
,, solid grease
COLLARS
COUPLINGS
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HANGERS adjustable
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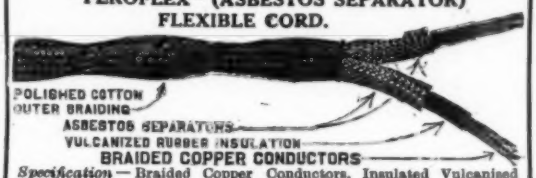

Specification — Braided Copper Conductors, Insulated Vulcanised Rubber, covered with Asbestos Yarn, the two Conductors twisted together and braided overall.

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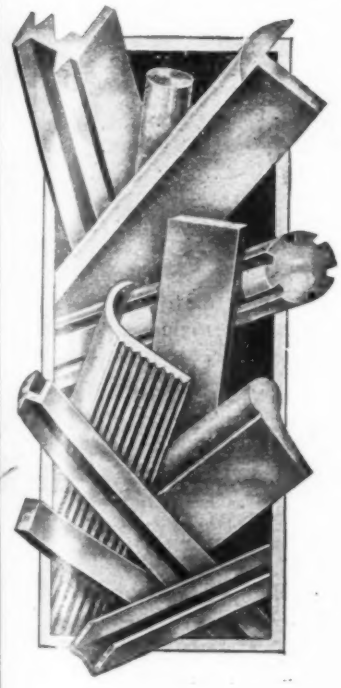

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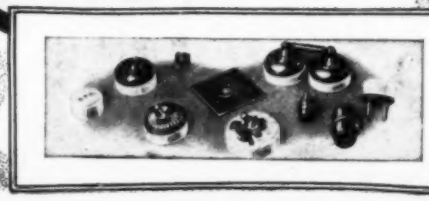
Installations by Mann, Egerton & Co., Ltd.



The Horseguards, especially the Whitehall frontage – always has a peculiar fascination for Londoners — no less than for Visitors to the Metropolis.

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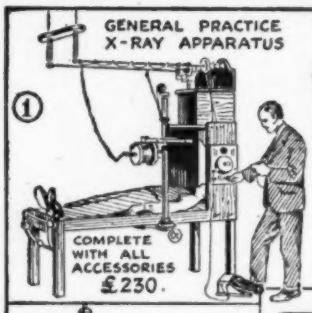
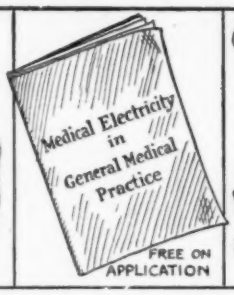


① COMPLETE WITH ALL ACCESSORIES £230.



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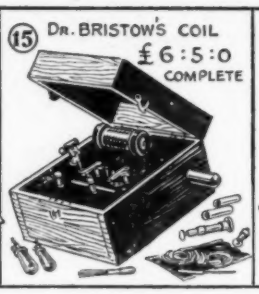

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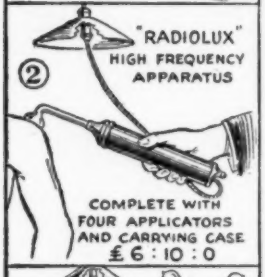

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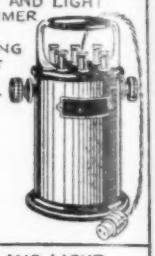
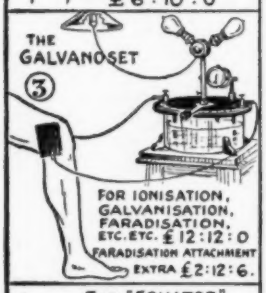


THE GALVANOSET

③



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CAUTERY AND LIGHT TRANSFORMER FOR DIRECT CURRENT SUPPLY. £26:0:0

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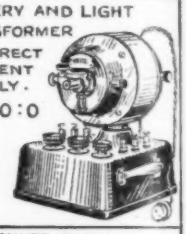
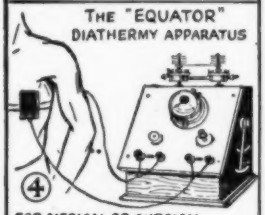


THE "EQUATOR" DIATHERMY APPARATUS

④



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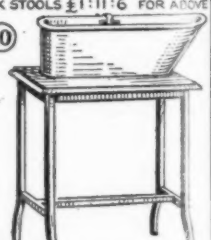

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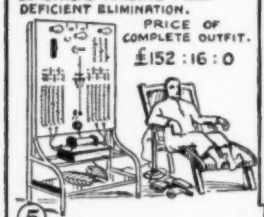

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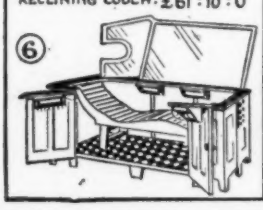

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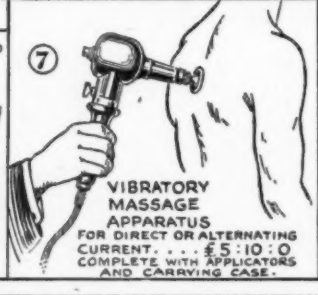

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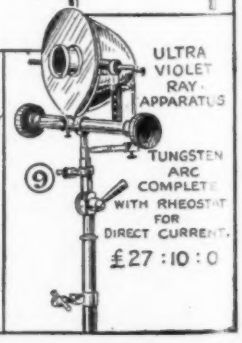

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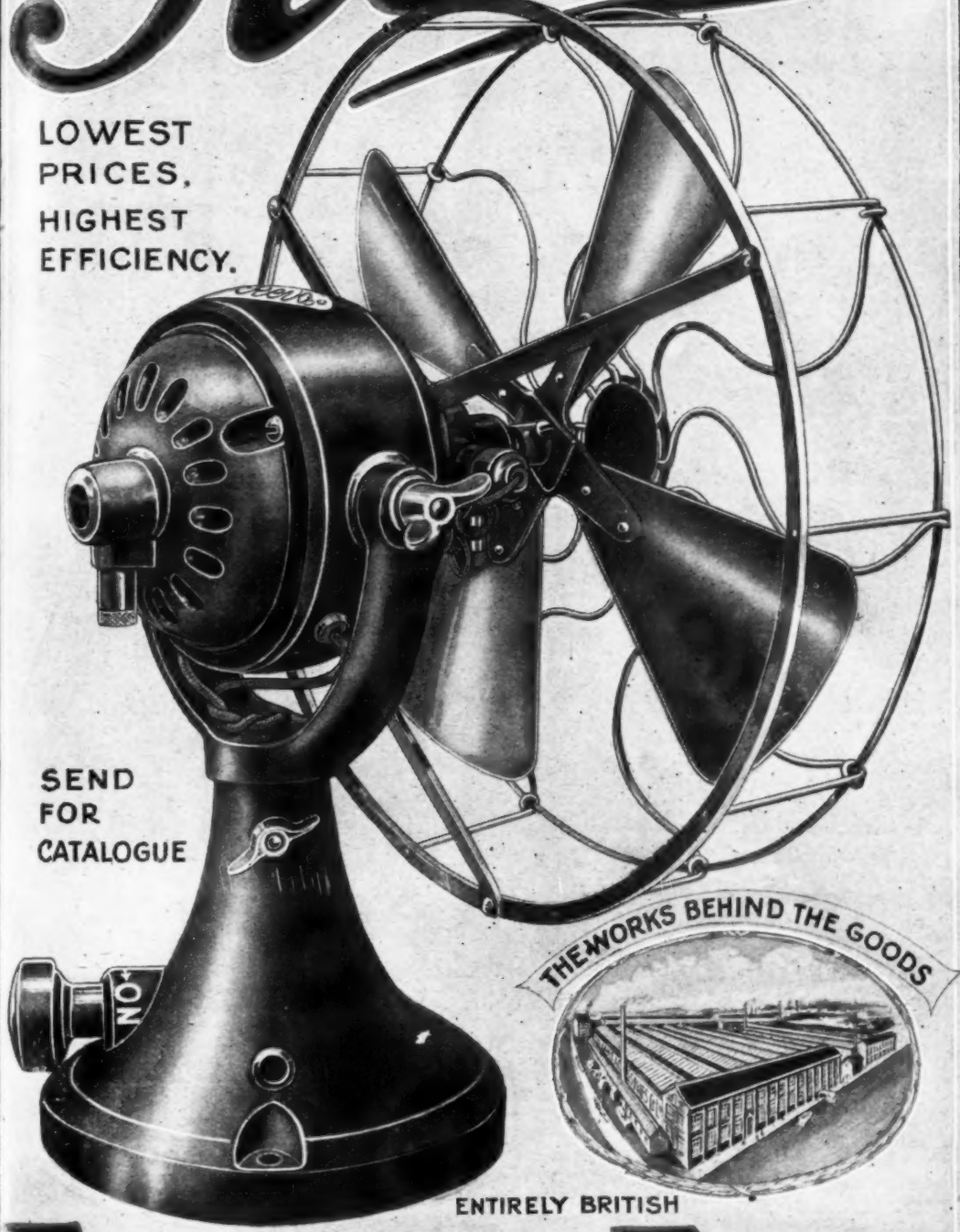

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THE CABLE ACCESSORIES Co. Ltd. TIPTON, STAFFS.

ONE OF THE J&P PAGES

The J. & P. Wiring System in the West Country

The Maynard School for Girls, Exeter, has recently been wired for Electricity on the J. & P. System by Mr. G. M. Challice, 69, Sidwell Street, Exeter.

Even the pupils of our best class educational establishments sometimes make their first acquaintance with electricity at school. It follows naturally that they will want it at home, and, with the insistence of the 'teens, worry their parents to install it. It is also certain that they will want it in their own homes when they grow up. The wiring of schools has therefore a propaganda value quite apart from the immediate profit attached to it.

Except for considerations of first cost, no school would nowadays have any other lighting system than electricity for five minutes. *The J. & P. Wiring System enables you to present the cost question in a totally changed form.*

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Its outstanding merit is the elimination of all jointing difficulties. All joints can be made outside the box, after which the cables with their sockets can be brought back into the case and the sockets secured to their stems.

The box can be fitted with wiping glands, armouring grips or tinned copper bonding tapes as shown.

Insulation throughout is of insulated steel rods, to which all fittings are rigidly connected.

The Box is split on the cable centre line, and the joints between the current-carrying portions—as also between the cover and body of the box—are packed with loco packing to ensure water-tightness.

Operation is very simple, each set of links being opposite to their respective cable, and a tab attached to each link of the same colour as the paper on its core.

The Box is tested to 3,000 v. before leaving our works, and its capacity is up to 1·25 four-core cable.

May we send you further details?

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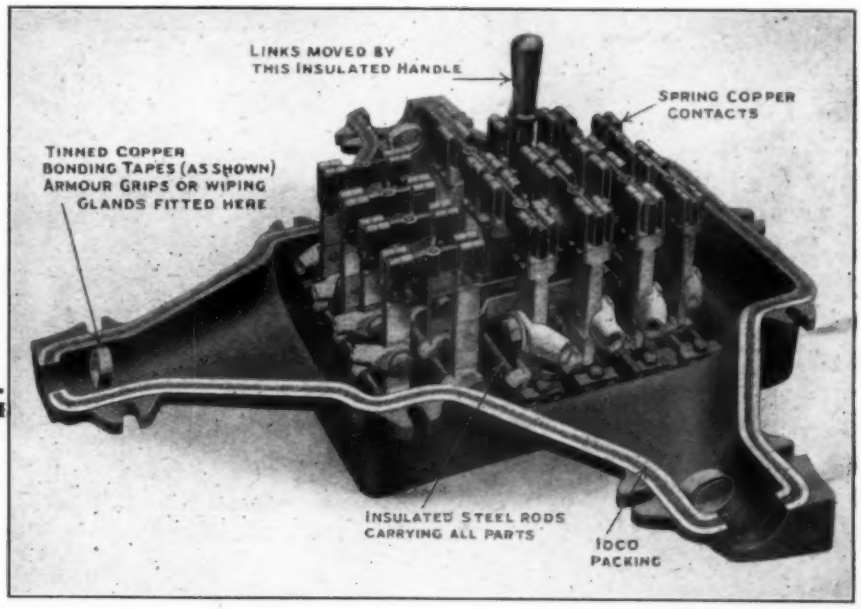
LINKS MOVED BY THIS INSULATED HANDLE
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TINNED COPPER BONDING TAPES (AS SHOWN) ARMOUR GRIPS OR WIPING GLANDS FITTED HERE
INSULATED STEEL RODS CARRYING ALL PARTS
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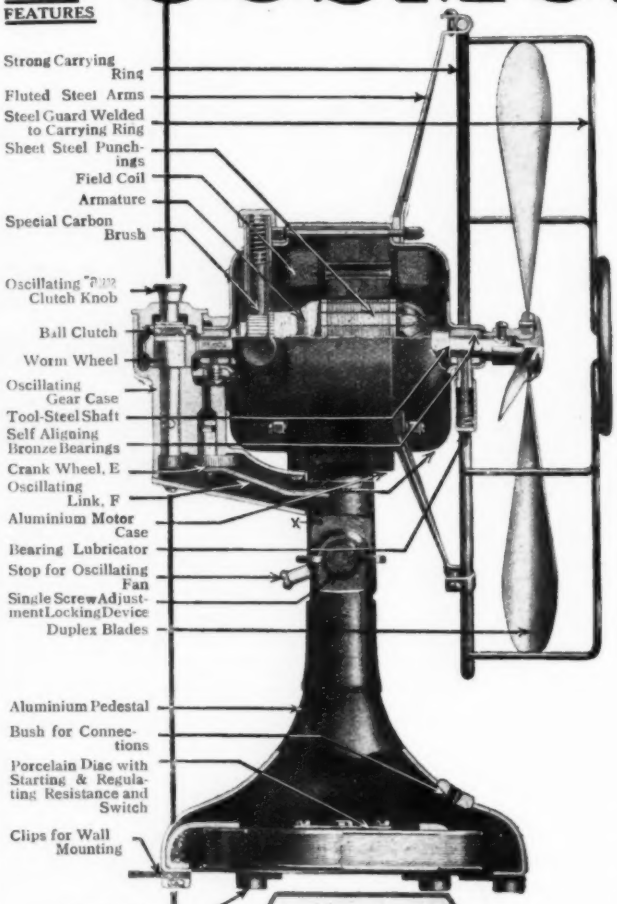

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E07

HAVE you made your arrangements yet, to obtain your fair share of the British Electric Fan business?

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"COSMOS" FANS

in standard types and suitable voltages.

These fans embody every possible refinement consistent with competitive prices, and you are invited to consider the stock at our nearest branch as YOUR stock.

Place your orders as soon as possible. Don't wait until the hot weather commences.

Send immediately for Trade List, if you have not already received it, and overprinted "give away" booklets F 1102.

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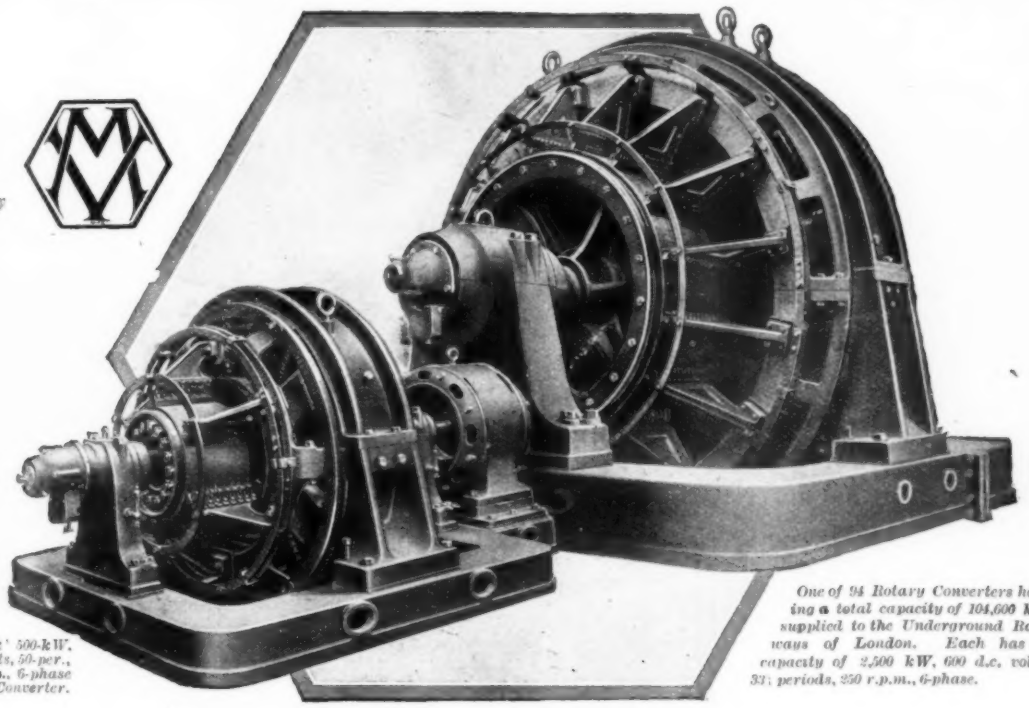

'Metrovick' 500-kW, 500 d.c. volts, 50-per., 1,000 r.p.m., 6-phase Rotary Converter.

One of 94 Rotary Converters having a total capacity of 104,600 kW supplied to the Underground Railways of London. Each has a capacity of 2,500 kW, 600 d.c. volts, 33⅓ periods, 250 r.p.m., 6-phase.

THE history of 'METROVICK' ROTARY CONVERTERS is a history of Repeat Orders. For Twenty Years the M.V. Co. has advocated consistently the employment of Rotary Converters and machines of this type, totalling over 750,000 kW capacity, have been sent from the Company's works to all parts of the world.

Practically all these machines have been and remain in continuous service, and the large number of repeat orders received is exemplified in the abbreviated list here given.

No. of Machines.	Total kW Capacity.	Purchaser.
53	60,700	London Underground.
41	43,900	London Metropolitan.
77	40,125	Glasgow Corporation.
25	21,010	Manchester Corporation.
32	20,800	Birmingham Corporation.
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32	17,390	Greenock Corporation.
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14	14,000	Bradford Corporation.
18	13,850	Salford Corporation.
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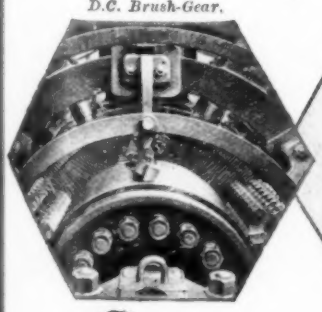
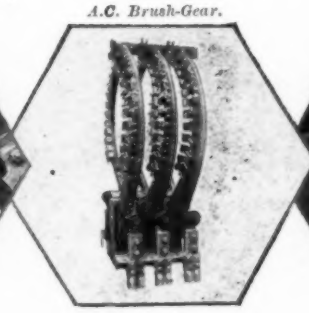
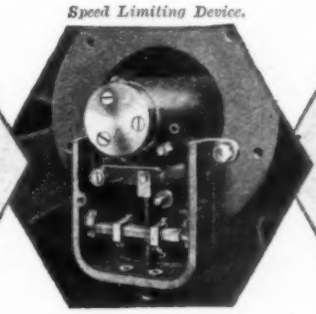


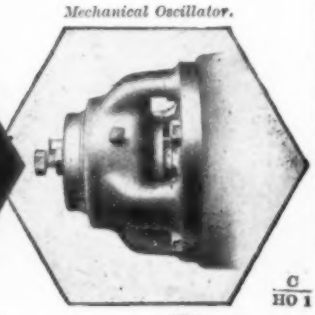
A.C. Brush-Gear.



Speed Limiting Device.



Mechanical Oscillator.



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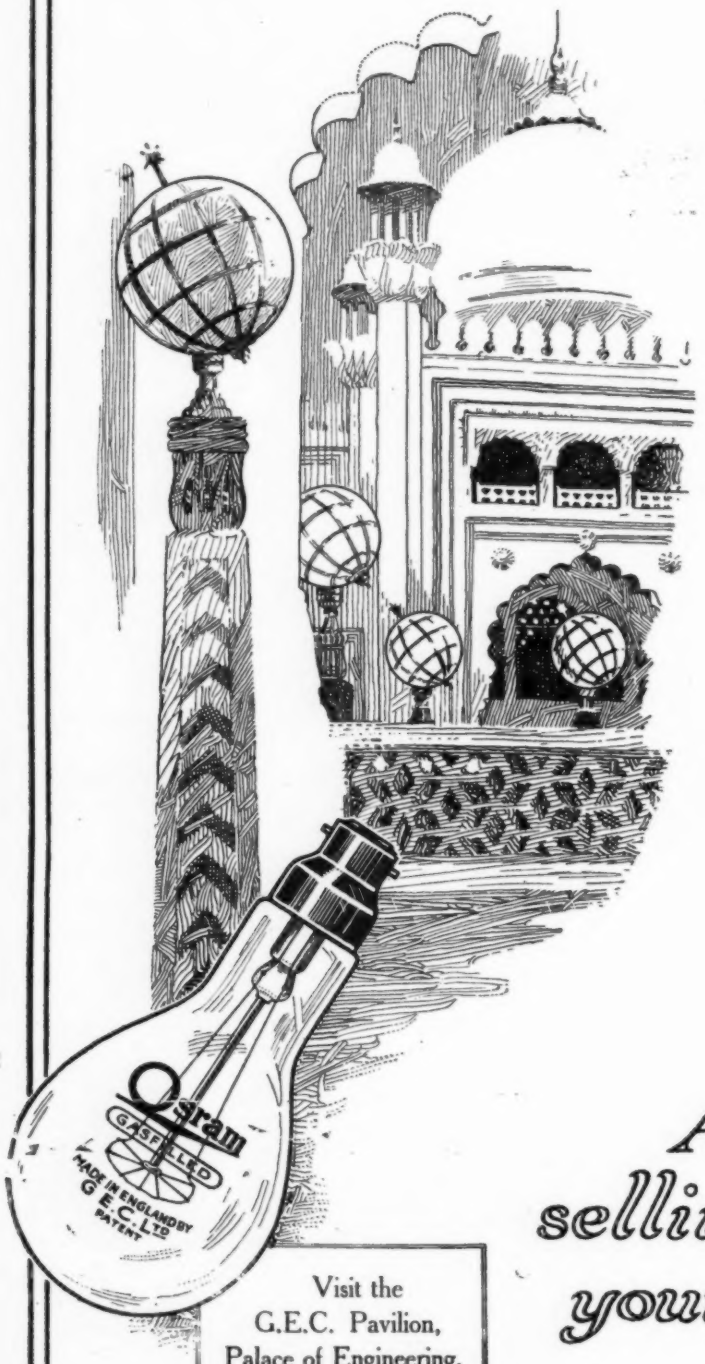

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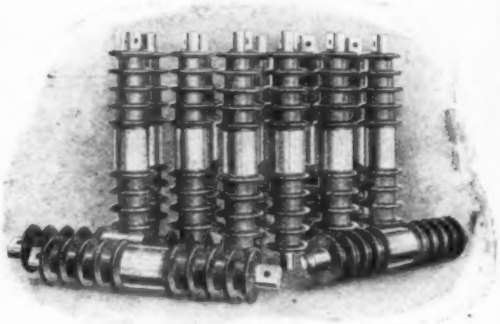

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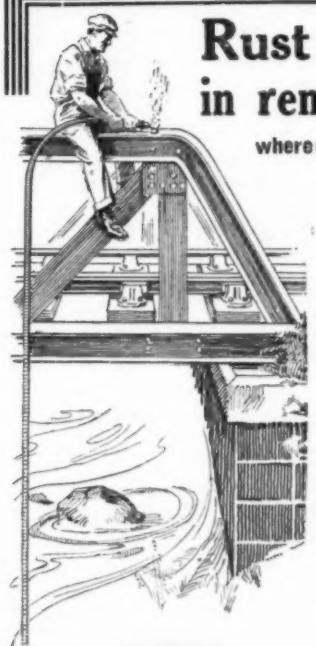

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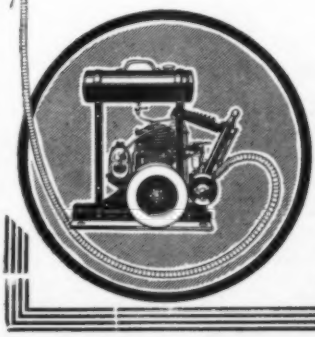

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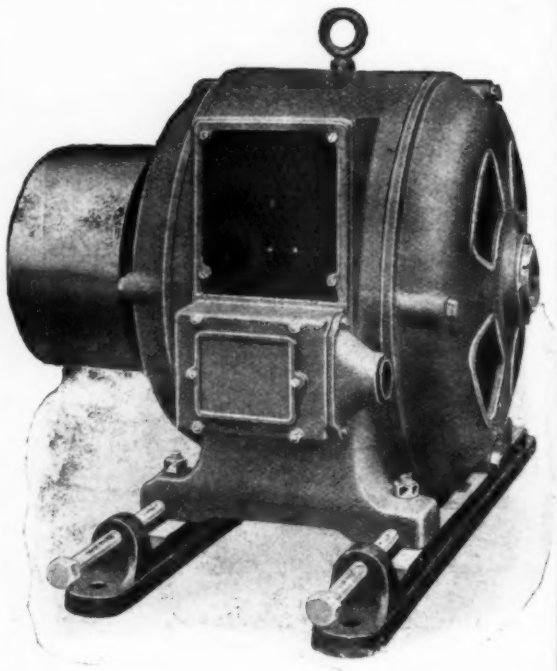

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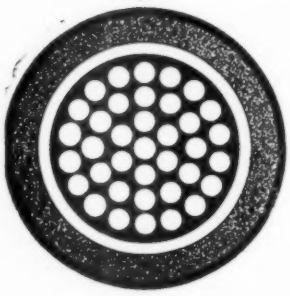

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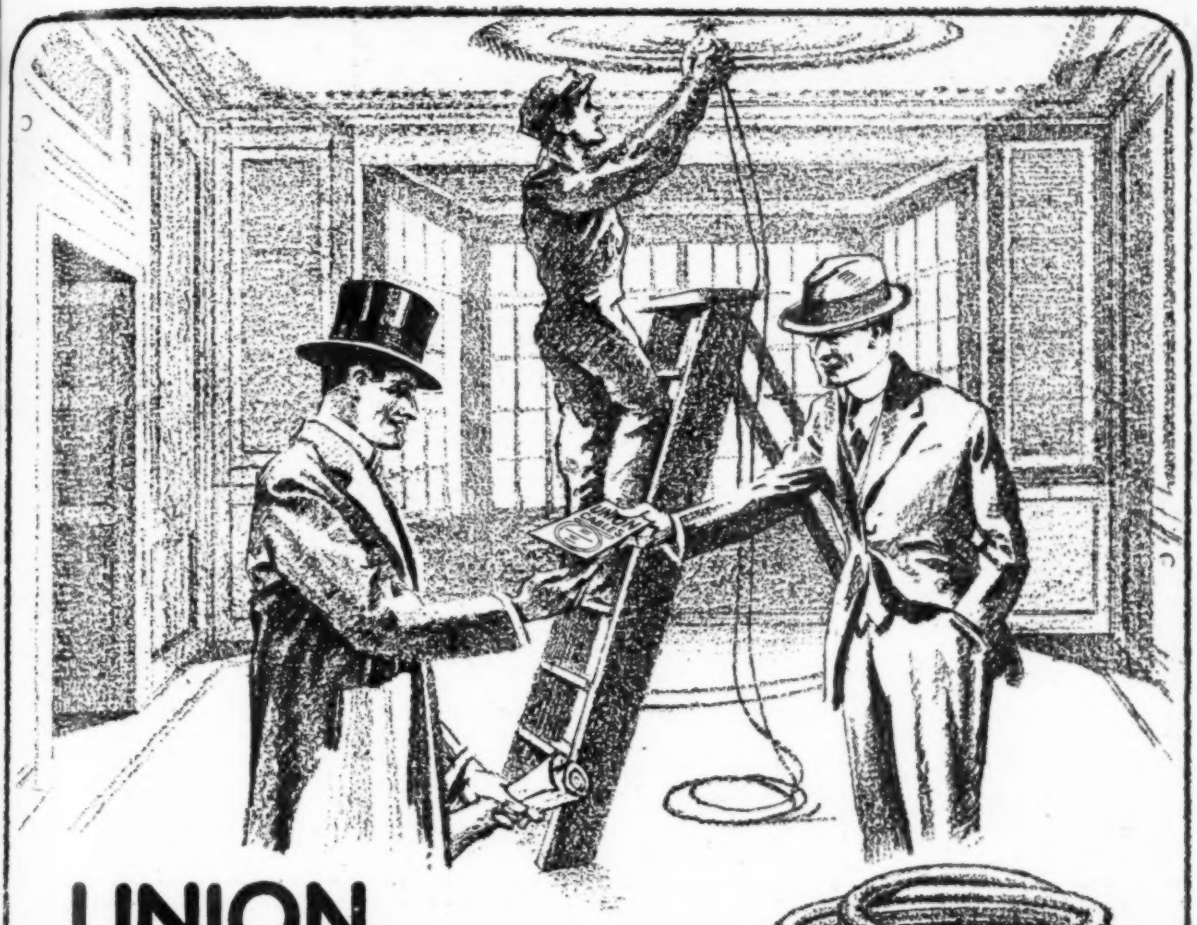

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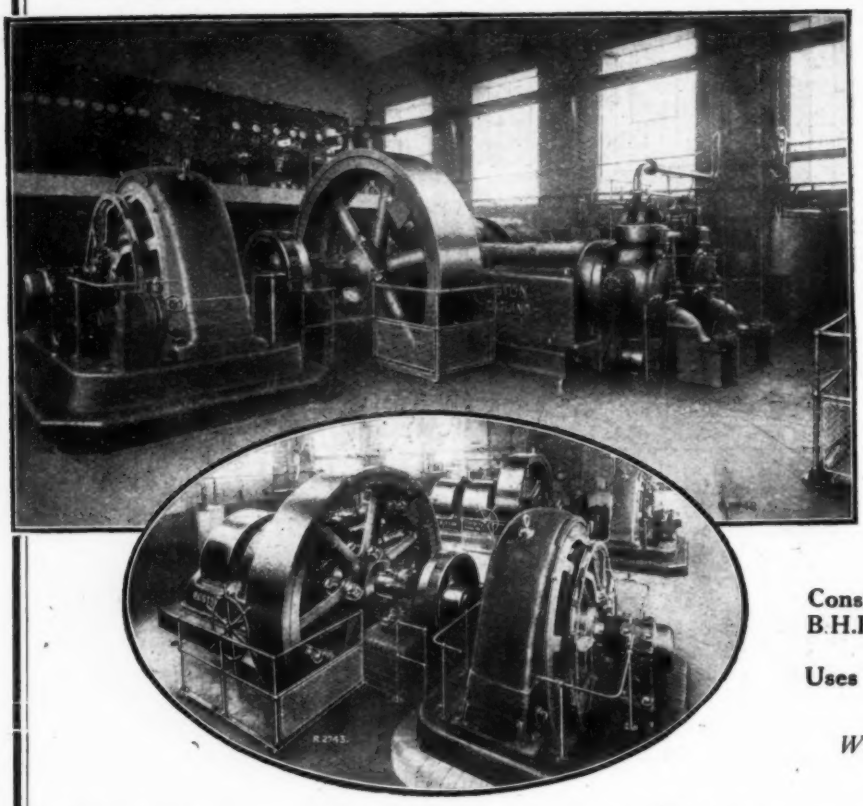

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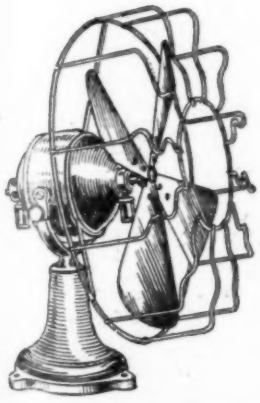

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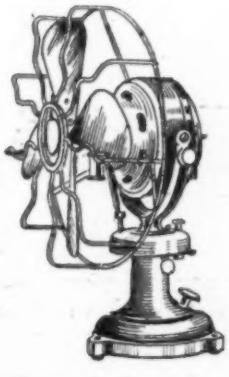

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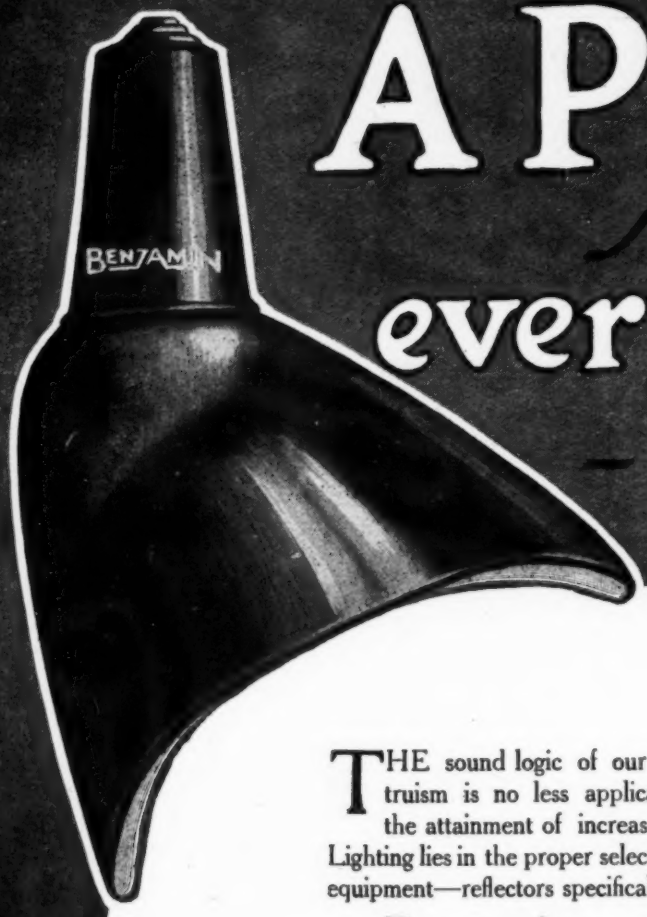

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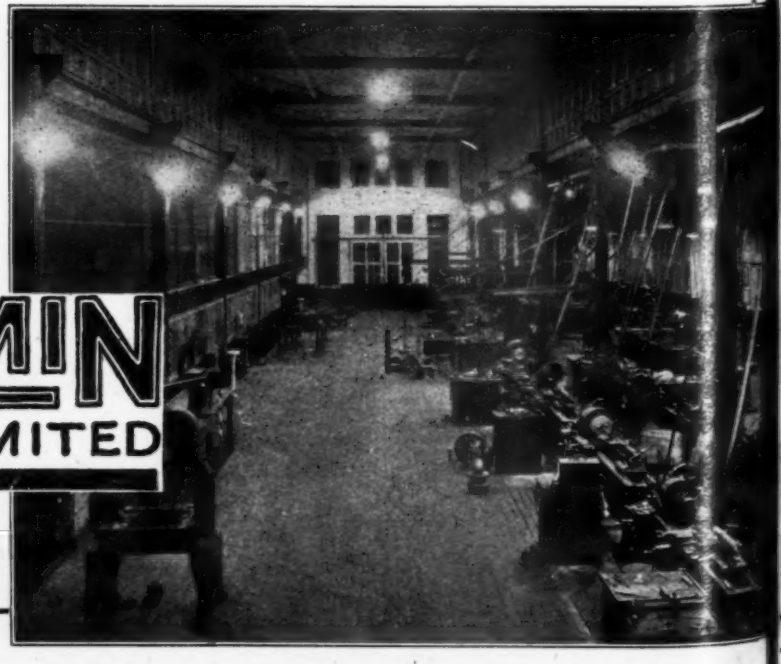

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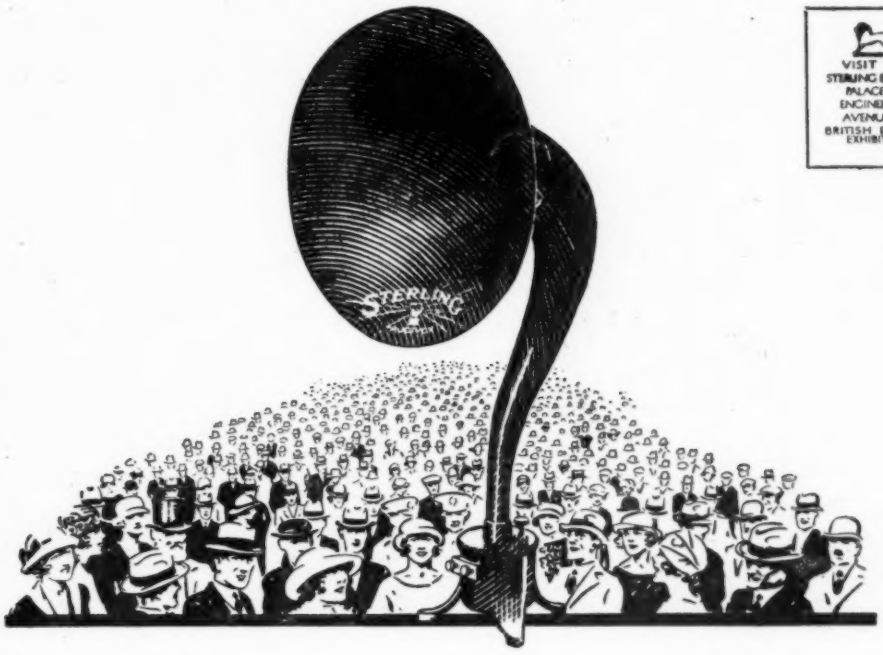

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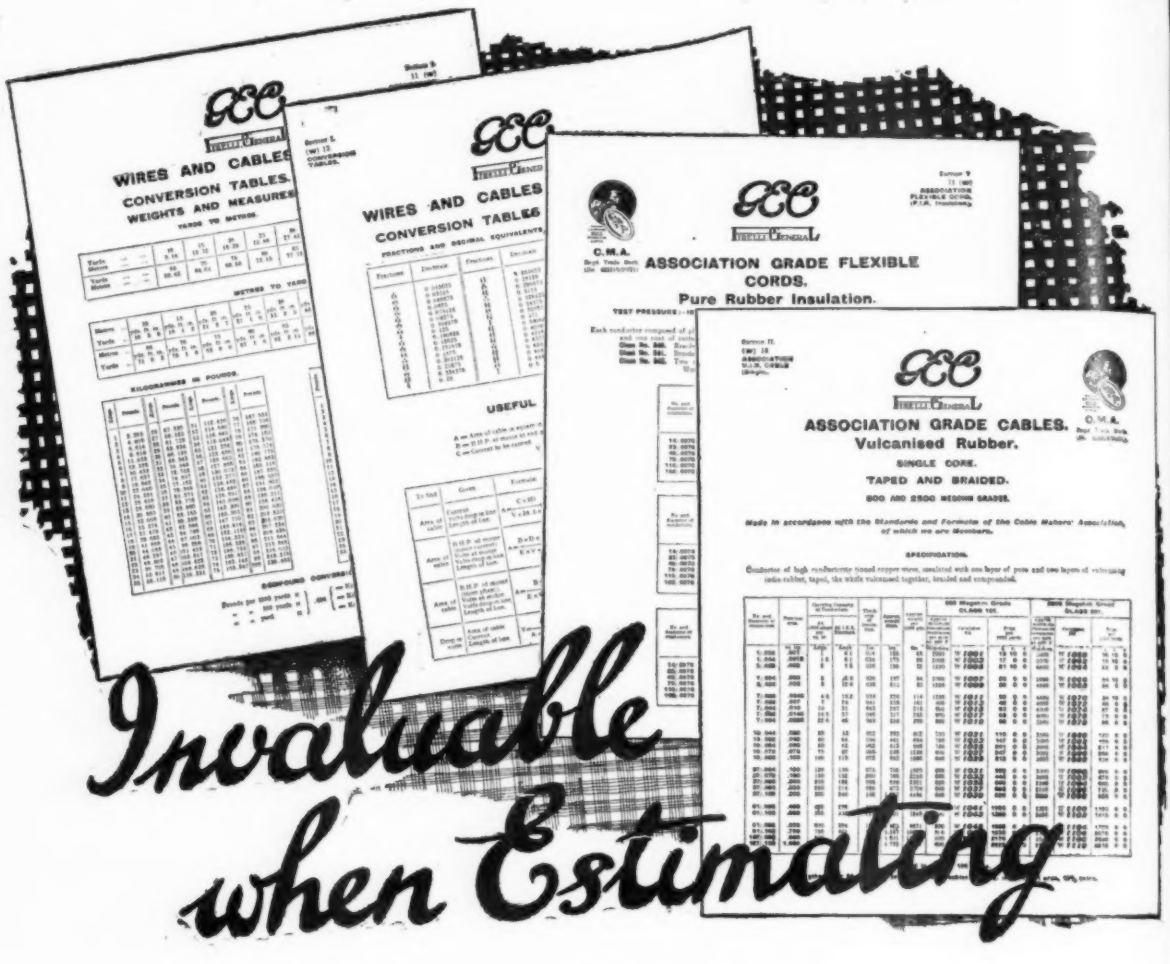

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46, Watling Street, London, E.C. 4. 16, Albert Square, Manchester.

26, Collingwood Street, Newcastle-on-Tyne.

PRELIMINARY ANNOUNCEMENT.

G. R.

BY DIRECTION OF THE GEORGE COHEN AND ARMSTRONG DISPOSAL CORPORATION.

ELECTRICAL EQUIPMENT,
GENERAL PLANT, BUILDERS' AND CONTRACTORS' MATERIAL.
STORES, &c.,
lying at
H.M. FACTORY, GRETNA (NR. CARLISLE),
comprising:—

ELECTRIC MOTORS, 25 H.P. TO 80 H.P.

Dynamos, Transformers, Electric Starters, Quantity of Electric Light Fittings, Switch Gear, Distribution Boards, Condensers, Super and Inter-Heaters, Stills, Saturators, Jacketted and other Pans.

100 VERTICAL TYPE COPPER-COIL CALORIFIERS,

Large Number of Tanks, up to 2,000 gallons capacity, Bowser Petrol Pumps, Water Meters, Fans, Blowers, Tangye Steam and other Pumps, Petter Oil Engine, Air Compressors.

WOODWORKING MACHINERY

consists of:—Dovetailing, Planing and 4 Cutter Moulding Machines, Hollow Spindle Lathe,

250 TONS OF STEAM PIPING AND FITTINGS.
BUILDERS' AND CONTRACTORS' MATERIAL,

comprising:—A Large Quantity of Rainwater Fittings, Tanks, Containers, Valves, Several Tons of Nails, Lavatory Fittings, Roof Trusses, Lifting Tackle, 500 Gross Steam Fittings, Gunmetal Valves, Steel Trunk Piping, Bends, Tees, Tubular Steel Masts, Lead-lined Trays, Platform Scales, Coal Grinding Machinery.

Quantity of Kitchen Utensils, Sports Outfits and Miscellaneous Items.

LEOPOLD FARMER & SONS,

will sell the above by auction

AT THE INSTITUTE, CENTRAL AVENUE, GRETNA,
on TUESDAY, 15th JULY, 1924, and following days,
at 11 o'clock each day.

On view several days prior to sale.

Catalogues of the Auctioneers, 46, Gresham Street, Bank, London, E.C.2, and Kilburn, N.W.6, or The George Cohen and Armstrong Disposal Corporation, Abbey House, Westminster, S.W.1. 3601

DISPLAYED ADVERTISEMENTS.

ADVERTISERS will please note that **NEW COPY and ALTERATIONS** to Existing Advertisements (with Blocks) should reach here not later than

THURSDAY MORNING.

SITUATIONS VACANT.

Latest time for receiving, 5 p.m. Tuesday.

Where Advertisements are to be answered to a given number at the ELECTRICAL REVIEW Office, applications for names and addresses of the Advertisers will be entirely disregarded.

Original Testimonials should never be sent.

AYRSHIRE ELECTRICITY BOARD.

APPLICATIONS are invited for the following appointments:—

(a) One Technical and Commercial Assistant. Applicants must have had experience in generation and distribution over a large area, also some commercial experience. The appointment will be in accordance with the E.P.E.A. Schedule, Class "F," Grade 7.

(b) One Mains Assistant. Applicants must have sound practical knowledge, and be capable of dealing with e.h.t. overhead and underground mains, l.t., d.c., and 3-phase distribution. Salary in accordance with the E.P.E.A. Schedule, Class "F," Grade 9.

(c) One Junior Mains Assistant. Applicants must have had experience in general a.c. and d.c. distribution, and with static transformers. Salary, £3 per week.

Applications, stating age, training and qualifications, together with copies of recent testimonials—endorsed according to the post the applicant is applying for—to be sent to—

WILLIAM C. BEXON,
Engineer and General Manager,
Ayrshire Electricity Board.

Greenholm Street, Kilmarnock. 3553

COUNTY BOROUGH OF BARNSLEY EDUCATION COMMITTEE.

Technical and Mining School.

Principal: D. PATON GRUBB, A.R.S.M., M.Eng., &c.

APPOINTMENT OF FULL-TIME TEACHER IN ELECTRICAL ENGINEERING.

THE Higher Education Committee invite applications from fully-qualified persons for the position of full-time Teacher in Electrical Engineering subjects. Degree or its equivalent and practical experience essential. Salary in accordance with Burnham Scale for Technical Teachers, less usual deductions.

Full particulars regarding the position may be had upon application to the Principal.

E. DAVIES, Director of Education. 3475

AUTOMATIC TELEPHONES.

Engineers Required for India.

ONE Operating Engineer with good maintenance experience, and Two Service Chiefs with maintenance and adjusting experience. Applicants must be single men.—For terms of engagement apply by letter only to Oriental Telephone Company, Alderman's House, Alderman's Walk, London, E.C.2. 3766

PAISLEY CORPORATION ELECTRICITY DEPARTMENT.

A PLUMBER Jointer is required, used to h.t. and l.t. paper cable and to making live service connections; four months certain, with probability of permanency to suitable man; standard rates.—Apply by letter to Engineer and Manager, 27, Blackhall Street, Paisley. 3544

CIVIL SERVICE COMMISSION.

FORTHCOMING Special Competition.—Male Assistant Superintendent of Traffic (Class II) in the London Telephone Service and Male Assistant Traffic Superintendent in the Provinces (18-23, with extension for service in H.M. Forces during the war), July 10th.

The date specified is the latest on which applications can be received. They must be made on forms, to be obtained, with particulars, from the Secretary, Civil Service Commission, Burlington Gardens, London, W.1. 3426

SITUATIONS VACANT.—*Continued.*

FOREMAN WANTED.

EXPERIENCED Foreman required by established manufacturing concern, to start and supervise new department for carrying out the process of fine wire drawing, enamelling and covering.—Only first-class men having extended experience and being capable of producing satisfactory results need apply, giving, in confidence, particulars of previous experience, age and salary expected, to 3531, Electrical Review, 4, Ludgate Hill, London.

THE ELECTRICAL POWER ENGINEERS' ASSOCIATION.

Halifax Corporation Electricity Department.

NOTICE is hereby given that a Dispute is in operation between the above Corporation and the E.P.E.A. Before applying for any vacancies advertised by the Corporation, all engineers are requested to communicate with the undersigned.

W. ARTHUR JONES,
General Secretary.

102, St. George's Square, London, S.W.1. 15

Cheap prepaid Advertisements are inserted under this heading at the rate of One Penny Per Word (minimum 1s.). Three Consecutive Insertions for the price of two, if ordered and prepaid with first insertion.
Box Number and ELECTRICAL REVIEW address count as seven words.

A COMMERCIAL and technical Assistant required in sales office and showroom. Experience in accessories, light fittings, &c.—3578, Electrical Review, 4, Ludgate Hill, London.

APPLICATIONS are invited for the position of Assistant Station Superintendent in a North Country 12,000-kW Generating Station. Please give full particulars of mechanical and boiler-house training, and other experience, and state whether married or single, age, salary required, &c.—3597, Electrical Review, 4, Ludgate Hill, London.

ARMATURE Winders wanted, good men required, Midland district. Piecework basis.—Reply, giving full particulars, past experience, and age, to 3546, Electrical Review, 4, Ludgate Hill, London.

ASSISTANT Charge Engineer.—Required, Assistant Charge Engineer in London power station. Salary Grade c. Class F. Applicants must have had at least three years' mechanical experience: received a public or secondary school and technical education. Preference will be given to applicants between the ages of 25 and 35 who have already held positions in high tension alternating power stations.—Application to be made on forms which can be obtained on June 27th from the Chief Engineer, 60, Eden Grove, Holloway, N.7, same to be returned not later than July 4th, 1924. 3586

ASSISTANT wanted in dynamo and automatic switch testing department of an engineering works in South London. Must have had good technical and practical works experience.—Write, stating age, experience and wages required, to 3590, Electrical Review, 4, Ludgate Hill, London.

ASSISTANT Wireless Engineer and Assistant Electrical Engineer (Telephones and Telegraphs), required by the Government of Hong Kong, for the Public Works Department, for three years, with prospect of permanency. Salary £460-£20-£950 a year, payable locally in dollars at the Government rate of exchange, which is at present fixed at 2s. to the dollar. In addition, a strictly temporary exchange allowance is at present paid, amounting to 20 per cent. of salary. Free 1st class passages, and, if married, for wife and children also not exceeding four persons beside the candidate selected. For the Assistant Wireless Engineer vacancy (M/12792) candidates, aged 25 to 30, must have had a sound education and technical training at a recognised college and should hold an Honours Degree in Engineering or Physics. They should have had subsequent practical experience in thermionic valve transmission and reception and in "Direction Finder" work. For the Assistant Electrical Engineer vacancy (M/12793) candidates, aged 25 to 30, should be corporate members of the Institution of Electrical Engineers and have held a similar position of trust. They must have had a sound practical and theoretical training and be capable of undertaking the supervision and satisfactory maintenance of all existing staff and apparatus, and of preparing plans and estimates for extensions. They must also have had experience in Automatic Exchange work and in the use of Valve Telephone Repeaters.—Apply at once by letter, stating age and particulars of experience, to the Crown Agents for the Colonies, 4, Millbank, Westminster, London, S.W.1, quoting the number shown against the appointment for which application is being made. 3571

ASSISTANT Distributing Engineer required for North Brazil. Single and about 25 years of age. Must have experience with meters, transformers and cable work. State age, salary required, experience, and when new duties could be taken up.—Write Box 572, c/o Judds, 81, Gresham St. E.C. 3552

DRAUGHTSMAN, junior, required with general electrical experience and knowledge of transformer design preferable.—State experience and salary required to 3583, Electrical Review, 4, Ludgate Hill, London.

DRAUGHTSMAN required, experienced in cable lay-outs for power stations.—State age, salary and experience, to 3579, Electrical Review, 4, Ludgate Hill, London.

DRAUGHTSMAN required in London district; good mechanical and electrical experience essential.—Apply, stating full particulars of experience, age, and salary required, to 3482, Electrical Review, 4, Ludgate Hill, London.

DRAUGHTSMAN, senior, for design of switchgear (North of England) wanted.—State age, salary and experience, to 3580, Electrical Review, 4, Ludgate Hill, London.

ELECTRICAL Engineer for London manufacturers' sales department. D.c. plant with batteries. Must have literary ability and must be good correspondent. Must have successfully handled general publicity and prepared catalogues and advertisements. Sound knowledge of current electrical practice. Experience with B.E.A.M.A. conditions preferred. Salary £300 per annum.—State age, experience, to 3536, Electrical Review, 4, Ludgate Hill, London.

ELECTRICIANS wanted, must be smart and capable of installing and repairing plant. Those with experience of X-Ray and Electro-Medical work preferred.—Applications in confidence to 8755, Electrical Review, 4, Ludgate Hill, London.

EXPERIENCED Designer for relays and small mechanisms wanted for North London.—Apply, stating age, experience and salary required, to 3480, Electrical Review, 4, Ludgate Hill, London.

FOREMAN Armature Winder wanted for Midlands, about 30. Must be an expert in the production of small and medium size armatures and stators, with female labour. Progressive position. Applications treated in strict confidence.—3362, Electrical Review, 4, Ludgate Hill, London.

JUNIOR Draughtsmen required by well-known firm of engineers (London district).—Apply, stating age and experience, to 3539, Electrical Review, 4, Ludgate Hill, London.

LEADING Stoker required for power house near London. Experience with large water-tube boilers and chain grate stokers essential.—3561, Electrical Review, 4, Ludgate Hill, London.

MANAGER required by firm of electrical contractors. Must have a good connection and experience in estimating and supervising work. Preference given to one willing to invest money in the company.—Reply, giving full particulars, 3521, Electrical Review, 4, Ludgate Hill, London.

OUTSIDE Representative wanted by West End Electric Supply Co., for interviewing and canvassing among consumers. Salary and good commission to a really "live" man. Only applications giving full particulars of experience and qualifications will be considered.—3565, Electrical Review, 4, Ludgate Hill, London.

REQUIRED, first-class Foremen, thoroughly used to the laying of e.h.t. cables, the handling of large gangs of men, and excavation and reinstatement in London and large towns. Reply, with copies of two last testimonials and state wages required. None but first-class men need apply.—3511, Electrical Review, 4, Ludgate Hill, London.

REQUIRED, first-class e.h.t. Plumbing Pointers, preferably with experience on 33,000-volt cables. Reply, with copies of last two testimonials and state wages required. None but absolutely first-class and thoroughly experienced jointers need apply.—3512, Electrical Review, 4, Ludgate Hill, London.

REQUIRED, first-class Foreman for North of England works, manufacturing power transformers. Applicants must have wide experience, modern practice in winding and insulating.—State age, experience and wages required, 3538, Electrical Review, 4, Ludgate Hill, London.

SALESMAN (indoor); young man required in electric heating and domestic appliances department of London wholesale distributors.—State age, experience and salary required, to 3556, Electrical Review, 4, Ludgate Hill, London.

SENIOR Assistant Electrical Engineers (shift duties) required temporarily for power and sub-station working on the North-East Coast. Applications, which must be in writing, will only be considered from those having had charge of a shift in a station containing large motor generators, rotary converters, and high-pressure switchboards.—Full particulars of theoretical and practical training, together with copies of references and date on which duties could be commenced, to be addressed to 3533, Electrical Review, 4, Ludgate Hill, London.

SITUATIONS VACANT.—*Continued.*

SEVERAL Draughtsmen, senior and junior, required for electrical switchgear work. Only men used to designing apparatus, or handling orders, need apply. Good openings for suitable men.—Apply in writing, stating experience, age, and salary expected, to The English Electric Co., Ltd., Stafford. 3537

SEVERAL young Electrical Engineers are required for training as Telephone Engineers (London district). Applicants must be of good appearance and have a good general education and a University degree or its equivalent (3 years' electrical course at some recognised College).—Apply by letter, stating age, full particulars of qualifications, and experience (if any) to 3538, Electrical Review, 4, Ludgate Hill, London.

SHIFT Charge Engineer wanted in Midlands, Class B Generating Station. Three-phase and d.c. plant, turbines, high speed engines and water-tube boilers.—State age and experience to 3568, Electrical Review, 4, Ludgate Hill, London.

SMART Man required as Assistant in sales and works management department. Must be of good appearance and have knowledge of works office routine.—3560, Electrical Review, 4, Ludgate Hill, London.

SWITCHGEAR Draughtsmen wanted immediately. London district. Good pay for really good men.—Write, stating age, experience and salary required, to 3545, Electrical Review, 4, Ludgate Hill, London.

TRACERS, Female, required by well-known firm of engineers (London district). Must be thoroughly experienced.—Apply, stating age and experience, to 3540, Electrical Review, 4, Ludgate Hill, London.

TRANSFORMER Designer and Draughtsman required by firm in London district. Please state experience, age and salary required.—8753, Electrical Review, 4, Ludgate Hill, London.

TRAVELLER wanted with connection by firm manufacturing for the trade the sheet metal parts of electrical heating and cooking apparatus of every description, in all metals. —8724, Electrical Review, 4, Ludgate Hill, London.

TRAVELLERS wanted for well-known wireless house. North Midland and East Riding, Lancashire, and North Eastern England areas. Commission basis only. Smart men with a connection preferred.—3367, Electrical Review, 4, Ludgate Hill, London.

UNIVERSITY or trained college man (just leaving) required to prepare connection diagrams for switchboards. Must have good knowledge of instruments. Small salary to commence; good prospects for advancement. London district.—Apply, stating qualifications, age, salary expected, &c., to 3596, Electrical Review, 4, Ludgate Hlll, London.

WANTED, Charge Engineer for modern e.h.t. power station of 4,500-kW capacity, connected with a large engineering establishment to which is attached a steel works. Applicants must have experience of Lancashire boilers and general maintenance of plant.—Replies, stating particulars of training, experience, age, salary required, &c., to 3587, Electrical Review, 4, Ludgate Hill, London.

APPOINTMENTS FILLED.

Dissatisfaction having been so often expressed that unsuccessful applicants are left in ignorance of the fact that the position applied for has been filled, may we suggest that advertisers notify us to that effect when they have arrived at a decision. We will then insert a notice free of charge under this heading.

BOX 8553 (Meter Inspector and Tester).

SITUATIONS WANTED.

Cheap prepaid Advertisements are inserted under this heading at the rate of One Penny Per Word (minimum 1s.). Three Consecutive Insertions for the price of two, if ordered and prepaid with first insertion.
Box Number and ELECTRICAL REVIEW address count as seven words.

A.A.A.—Electrical Engineer, at present holding important appointment East, is desirous remaining in England; thoroughly experienced in all branches and of good address; personal interview; would invest £2-3,000 if necessary after fullest investigation.—8802, Electrical Review, 4, Ludgate Hill, London.

A.A.A.—Electrical Engineer (33), 16 years assembly, installation, testing, maintenance, d.c. and a.c. electrical machinery and switchgear with well-known firms. First-class knowledge modern automatically controlled printing press equipments. Good technical knowledge. Public school education. Desires progressive appointment.—Kinch, 5, Colindeep Lane, Hendon, N.W.9. 8776

SITUATIONS WANTED.—*Continued.*

A.A.A.—Electrical Engineer, single, age 36, A.M.I.E.E. Sound electrical and mechanical training and experience with manufacturers and merchants. Accustomed all types a.c. and d.c. plant, internal combustion engines, &c. Installation, maintenance, sales, estimating, buying, supervision of contracts, correspondence, control of inside and outside staff. Energetic, adaptable, and good organiser. Now disengaged. Moderate salary for progressive appointment.—8728, Electrical Review, 4, Ludgate Hill, London.

A.A.A.—Electrical Engineer, A.M.I.E.E., M.Am.I.E.E., desires responsible appointment. Recent experience includes position as assistant chief electrical engineer to large supply company with full charge of system, including sales dept., power station, sub-stations, distribution system, &c. Also electrification of railways and maintenance work, with supervision of repair shop and maintenance of locomotives and rolling stock. Earlier experience includes steam locomotive construction and repairs, drawing office, testplate, and estimating work with electrical manufacturing company; also power station and sub-station operation. Good organiser and correspondent. Excellent references.—8628, Electrical Review, 4, Ludgate Hill, London.

A.A.A.—Electrical Engineer (33), seeks responsible appointment. Experience: Technical staff appointments with public supply undertakings; charge of cable manufacturer's test room; installation of and entire management large factory plants; estimating, correspondence, control of staff. Moderate commencing salary.—8638, Electrical Review, 4, Ludgate Hill, London.

A—ALL-round long experienced Electrician, screwed installations.—Jobing, 106, Kingsley Road, Hounslow. 8777

A FIRST-Class Mechanic seeks situation; 23 years' experience, light engineering, electrical, experimental, tools, jigs, gauges, excellent references. London district.—8779, Electrical Review, 4, Ludgate Hill, London.

ABROAD.—Competent Electrical Engineer, 27, desires progressive position requiring initiative and resource. Technical College training (Diploma), Stud. I.E.E., 9¼ years' practice (4 years in tropics). Charge of d.c. and a.c. (l.t., h.t., e.h.t.), steam, petrol and oil plant. Design, manufacture, test, specification, installation, maintenance and repair of commercial electrical apparatus. Fluent Hindustani, knowledge of Burmese, French, and Spanish.—8640, Electrical Review, 4, Ludgate Hill, London.

ADVERTISER, mechanical electrician, 20 years' experience in electrical machine repairs, lighting, power, private plants, domestic appliances, seeks engagement with contractor. —8774, Electrical Review, 4, Ludgate Hill, London.

ADVERTISER, A.M.I.E.E., A.M.I.Mech.E., with exceptional experience, desires position as General or Departmental Manager. Wide experience with the commercial management of sales and contract department, public electricity supply and staff management; good correspondent, having tact and ability. Experienced in electric lighting, heating, cooking and power, also central heating, ventilating, &c. Excellent testimonials and references.—Reply 8684, Electrical Review, 4, Ludgate Hill, London.

ADVERTISER seeks position as Junior Draughtsman or Technical Clerk in engineer's office; Secondary education; 5 years' engineering apprenticeship.—Apply F. Adams, 41, Saltram Cres., Maida Hill, W.9. 8695

ADVERTISER desires situation for smart Boy (15½) to learn electrical engineering.—James, 15, Raynham Avenue, Edmonton, N.18. 8673

ADVERTISER, experienced charge, shift, senior switchboard attendant, seeks position.—J. Browning, c/o E. Jillings, 51, Heaton Road, Heaton, Newcastle. 8677

ADVERTISER seeks situation on e.h.t. overhead transmission line construction. Any capacity. Home or abroad. Splendid references.—8665, Electrical Review, 4, Ludgate Hill, London.

ADVERTISER (46), desires position, London or Provinces, as Sales, Installation Engineer or Contractors' Manager; thorough technical and commercial experience with supply undertaking and contractors; wide experience; fully conversant with specifications, estimating, and carrying out of extensive contracts.—8688, Electrical Review, 4, Ludgate Hill, London.

ADVERTISER (25), requires position with electrical firm; 3½ years' varied practical experience, 4 years technical college, terminating July 4th. Reasonable salary.—8610, Electrical Review, London.

ADVERTISER, with 20 years' control of Sales and Contract business, desires engagement where a live man can make progress. Highest references. Lighting and power contracts and office routine.—8619, Electrical Review, 4, Ludgate Hill, London.

SITUATIONS WANTED.—*Continued.*

ADVERTISER (21¼), minor public school education, recently finished five years indentured electrical apprenticeship, theoretical knowledge, acquainted with wireless and components, desires to take up Salesmanship.—8623, Electrical Review, 4, Ludgate Hill, London.

ALL-ROUND young Electrician seeks berth with genuine firm, sound practical wiring and fault-finding experience, wireless and foreign experience.—8759, Electrical Review, 4 Ludgate Hill, London.

ARMATURE Winder, first-class, desires change; new or repairs.—8783, Electrical Review, 4, Ludgate Hill, London.

ARMATURE Winder, 14 years' experience, a.c. or d.c.; repetition or repair work.—8748, Electrical Review, 4, Ludgate Hill, London.

ARMATURE Winder, with 14 years' first-class experience in manufacture and repairs, seeks position; all types a.c. and d.c.—8770, Electrical Review, 4, Ludgate Hill, London.

B.Sc. Honours Electrical Engineering (24) requires progressive post. Works and switchgear estimating experience; knowledge French, slight German. Ex-officer.—8675, Electrical Review, 4, Ludgate Hill, London.

CAPABLE Engineer, A.M.I.M.E., managerial experience, workshops, foundries, efficient draughtsman, estimator, &c., seeks part-time engagement. Moderate terms. Has own London office.—8771, Electrical Review, 4, Ludgate Hill, London.

COLLIERY Assistant Electrician (26), single, practically and technically trained. Experienced erection and maintenance of three-phase colliery plant.—8775, Electrical Review, 4, Ludgate Hill, London.

COMPETENT Engineer, electrical and mechanical, desires position as manager or installation engineer; interviewing, estimating, control of men, office routine; highest references.—8799, Electrical Review, 4, Ludgate Hill, London.

ELECTRIC Lamps and Valves.—Successful Works Manager requires same or suitable position, home or abroad.—Write, 123, Walthew Lane, Platt Bridge, Wigan. 8664

ELECTRIC Lamp Makers.—The decision of the Court of Appeal in favour of the British Insulated & Helsby Cables, Ltd., enables non-Association lamp makers to at once restart manufacturing operations. The advertiser will be pleased to hear from any non-ring firm desiring the services of a Manager, Assistant Manager, or Works Chemist and Physicist for their factory.—8631, Electrical Review, 4, Ludgate Hill, London.

ELECTRICAL Heating, Cooking and Hot Water.—Engineer, now representing prominent manufacturers in Lancs. and Yorks., desires increased scope, either district representative or on expense-commission basis. Manufacturers needing personal introduction to buyers (corporation, trade, industrial), address 8781, Electrical Review, 4, Ludgate Hill, London.

ELECTRICAL Engineer (34), knowledge foreign languages, Public School; seven years' commercial experience, 3 years salesman; at present in employ of large company. Seeks opening in London or South.—8706, Electrical Review, 4, Ludgate Hill, London.

ELECTRICIAN (Wireman), thoroughly reliable. All kinds of wiring, tubing, casing, &c.—G., 40, Rattray Road, Brixton. 8645

ELECTRICIAN, with 16 years of practical experience in all branches, maintenance for preference.—M., 31, Eton Street, Regent's Park. 8729

ELECTRICIAN, 15 years' experience lighting, heating, power, also maintenance, plant work, &c. Good references.—E. B., 108, Upper Kennington Lane, S.E.11. 8644

ELECTRICIAN, lighting, power, bells, telephones, all systems; experienced.—30, Chestnut Grove, Balham. 8804

ELECTRICIAN wants work, town or country; good references.—P. A. Maynard, 20, Archer Mews, Archer Street, Notting Hill, W.11. 8796

ELECTRICIAN, experienced mechanic; lighting, bells, 'phones, motors, a.c. or d.c.—"Electrician," 325, Kilburn Lane, N.W. 8780

ELECTRICIAN-Wireman, all systems, lighting and power, age 30.—N. A. Daniels, 27, Concanon Road, Brixton. 8779

ELECTRICIAN-Wireman desires situation with firm doing country house lighting; used to petrol and oil engines.—8794, Electrical Review, 4, Ludgate Hill, London.

ELECTRICIAN (25), single, adaptable, conscientious, seeks situation; practical and theoretical experience of lighting systems, power, printing press equipment, automatic controllers, country house installations, &c.—T. B., 50, Tantallon Road, Balham, S.W.12. 8750

SITUATIONS WANTED.—*Continued.*

ELECTRICIAN, Engineer, Improver. Youth, 17, wants permanent work; 3 years present job, best of recommendations; well up in bells, 'phones, wireless.—Wright, Bookstall, Marble Arch Tube, W.1. 8761

ELECTRICIAN, Millwright, 16 years' experience. Shafting, machinery, lighting, power, maintenance, &c.—Write Powell, 70, Standen Road, S.W.18. 8713

ELECTRICIAN, good all round; would take charge.—F. Hooper, 7, Barnsdale Road, Maida Hill, W.9. 8718

ELECTRICIAN, disengaged; power, light, telephones, bells, &c.—Tilbrook, 37, Octavia Street, Battersea. 8697

ELECTRICIAN (Wireman), reliable, all kinds of wiring, tubing, casing, &c.; good references.—E. F., 14, Brinton Road, Hereford. 8702

ELECTRICIAN-Wireman (24), seeks change, within 50 miles North London preferred. Lighting, heating, a.c. and d.c., power, plant work.—8703, Electrical Review, 4, Ludgate Hill, London.

ENGINEER-Electrician desires re-engagement as manager or contractors' foreman with progressive firm. Thoroughly competent, gas, oil, petrol, erection, maintenance, private estate work. Keen estimator competitive contracts, office routine; London experience. Highest testimonials.—8639, Electrical Review, 4, Ludgate Hill, London.

ENGINEER.—Sales Manager requires position, either in works or on sales. Seven years' experience electric battery, truck and locomotive design, manufacture and sale. Produced first electric battery truck in England.—8626, Electrical Review, 4, Ludgate Hill, London.

ENGINEER (37), requires appointment, administrative, technical, manufacture, construction, branch office management; experienced power station plant, sub-stations, motors, switchgear, cables, transformers, control technical staffs, drawing office, and workmen.—8704, Electrical Review, 4, Ludgate Hill, London.

FIRST-Class Electrician-Wireman seeks situation; all systems.—11, Southampton Buildings, Lymington, Hants. 8749

INSTRUMENT maker and small engineering toolmaking jigs and patterns, used to experimental work to drawings.—Parker, 18, Elmcroft Crescent, Golders Green. 8798

MAINTENANCE Electrician, used to engines, dynamos, motors, batteries, pumps, &c., running repairs, wiring and pipework; town or country. Moderate wage for permanency.—8790, Electrical Review, 4, Ludgate Hill, London.

MARINE Engineer (32), 1st class B.O.T., 12 years with present company, 5 years as 2nd engineer. Experience in running and overhauling of turbines, reciprocating and semi-Diesel engines, oil fuel and d.c. plant, desires position ashore in large plant or factory, any district, where the above experience, including energy and initiative, are required. First-class references.—King, 297, Whitehorse Lane, London, S.E.25. 8768

SALES Engineer.—Long and successful experience with important firms; at present disengaged. Forceful interviewer, who can handle large contracts. Fully technical.—8301, Electrical Review, 4, Ludgate Hill, London.

SHIFT Engineer, single, 28; experienced large power and substations, all types modern plant, seeks change, preferably abroad.—8767, Electrical Review, 4, Ludgate Hill, London.

SMART Boy, tall, aged 16, just leaving school, with some mechanical and technical training, seeks a situation with electrical and mechanical engineers.—A. Yapp, 15, Garfield Road, Wimbledon, S.W. 8685

TELEPHONE Engineer, 23; good practical and theoretical knowledge. London and City Guilds telephony certificate. Home or abroad.—8805, Electrical Review, 4, Ludgate Hill, London.

TRAVELLER seeks permanent position. Everything electrical and wireless; good connection Home Counties; commission basis only not entertained.—8686, Electrical Review, 4, Ludgate Hill, London.

WIRELESS, Electrical Accessories, &c.—Electrician, 23, requires post in retail business; security if required.—L. M. F., 10, Courthope Villas, Wimbledon. 8763

WIREMAN, all-round; can estimate; make good.—W., 58, Richmond Road, Bayswater. 8695

WIREMAN (36), good all round, disengaged.—A. F., 82, Harrow Road, W. 8719

WIREMAN, good all round; 22 years' experience.—Sams, 48, Ingelow Road, Battersea. 8715

WIREMAN seeks situation anywhere; maintenance, jobbing, house wiring. Good references.—C. Jenkins, 38, Walterton Road, Paddington. 8690

SITUATIONS WANTED.—*Continued.*

WIREMAN, disengaged.—10, Lynwood Road, S.W.17. 8795

WIREMAN, good all-round; 18 years' experience; age 35. References.—A. A., 67, Hartismere Road, Fulham. 8800

WIREMAN, all branches, wants work.—Haines, 4, [illegible] Street, N.W.1. 8792

WIREMAN wants job, any system.—Robinson, 5, Agincourt Road, Hampstead. 8780

WIREMAN'S Assistant requires work; 3½ years' all-round experience.—Eddowes, 82, Choumert Road, Peckham, S.E.15. 8791

YORKSHIRE.—Mr. W. F. Lawrence, late representing the Telephone Manufacturing Co., Ltd., requires engagement with established house having competitive lines in fittings, wireless, &c. Sound connection.—Write: 13, Wilton Grove, Headingley, Leeds. 8819

YOUNG Electrician (22), requires situation, apprentice served, conversant with d.c. and a.c. power and lighting. Home or abroad.—8778, Electrical Review, 4, Ludgate Hill, London.

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BURY ELECTRICAL PLANT CO., LTD., Phœnix Street, Bury. 3504

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200/250 volts d.c.: 3, 5, 7, 8, 10, 15, 18, 20, 25, 50, 70 and 100 h.p.
400/500 volts, d.c.: 5, 10 (tot. encl.), 15, 20, 25, 30, 40, 65, 70, 75 and 90 h.p.
400/500 volts, 3-phase, 50 periods: 1, 2, 4, 6, 10, 12, 18, 20, 25, 40, 50, 75 and 100 h.p.
200 volts, 1-phase, 50 periods, 18 h.p., slip-ring.
Ventilating Fan, 30 in., 220 volts, d.c., box blades.

GREENHALGH BROS., Atherton, Manchester.
'Phone: 117 Telegrams: Greenhalgh Bros., Atherton 17

DIESEL ENGINES FOR SALE.

DIESEL Engines, 300, 530, 800, 1,200 and 1,750 b.h.p., M.A.N., with or without dynamos, condition as new; about one-third market price; seen London. All spares for above sizes in stock.

HICK DIESEL OIL ENGINES, LTD., 70, Queen Street, E.C.4. 3017

STEAM GENERATING SETS.

300-kW, 500-volt, d.c. Belliss-B.T.H.
80-kW, 500-volt, d.c. Belliss-Dick, Kerr.
75-kW, 500-volt, d.c. Allen.
25-kW, 220-volt, d.c. Allen.
50-kW, 110-volt, d.c. Allen.
25-kW, 110-volt, d.c. Belliss and Allen.

And Oil Generating Sets. Modern.

HARRY H. GARDAM & Co., LIMITED, STAINES.
'Phone 98. 3322

440-Volt, d.c. Motors in First-class Condition.

ONE 34½ h.p., 1,020 r.p.m., B.T.H.
One 30 h.p., 880 r.p.m., Siemens.
One 25 h.p., 1,100 r.p.m., Westinghouse.
One 15 h.p., 1,100 r.p.m., Westinghouse.

L. A. GAMBLEN & PARTNERS, 10, East Parade, Sheffield. 3419

FOR SALE.—*Continued.*

ELECTRICAL POWER PLANT FOR SALE.

All Genuine Second Hand—Guaranteed Sound.

A.C. Steam Sets.—375 to 2,000 kW.
Example: One 1,000-kW, 3,300-volt B.T.H. Turbo Set with condensing plant, equal new, £2,000.
D.C. Steam Sets.—26 to 1,500 kW.
Examples: One 750-kW, 220-volt Geared Turbo Set with condensing plant, new 1917, £1,800.
Two 325-kW, 500-volt Steam Sets, £650 each.
One 375-kW, 240-volt ditto, £600.
Transformers, new and unused.—500 to 1,500 kW.
6,600/440 volts, 50 cycles, 3-phase.
Babcock Boilers.—Nothing over 8 years old.
5,000 to 30,000 lb. per hour, 160-200 lb. w.p.
Lancashire Boilers.
Example: Four 30 ft. by 8 ft. by 160 lb. w.p., £350 each.
A.C. Motors.—220 to 3,000 volts.
25, 40 and 50 periods, 5 to 500 h.p.
D.C. Motors.—220 to 500 volts, 4 to 600 h.p.
Examples: 15 h.p., £30; 20 h.p., £40; 30 h.p., £55; 50 h.p., £75; 75 h.p., £100; 120 h.p., £130; 150 h.p., £150; 200 h.p., £185; 500 h.p., £400.
We have also a large number of Motor-Generators, Rotary Converters, Motor-driven Pumps, Air Compressors, &c., &c.
We control one of the largest stocks of second-hand electrical machinery in the country, and there is hardly any class of electric or electrically-operated plant we cannot quote for.

COME TO THE SOURCE OF SUPPLY.

FYFE, WILSON & CO., LTD., 31, Budge Row, London, E.C.4.
3442

ELECTRIC LAMPS! ELECTRICAL ACCESSORIES!!

BUY your Electric Lamps at the right price from us. Guaranteed non-infringing! Complete indemnity!!

Drawn Wire Electric Lamps, 10 to 60 watt	...	9/6 per doz.
Half-Watt Type F.W., 30-40-60 watts	...	16/- ,,
Ditto, 100 watts	...	18/- ,,
Traction Lamps, 20-30-40-60 watts	...	15/- ,,
Candle Lamps, 20 watts	...	20/- ,,
Carbon Lamps, 5-8-16 watts	...	12/- ,,
Ditto, 25-32 watts	...	14/- ,,
Automobile Lamps, "Headlight," from	...	15/- ,,
Ditto, "Sidelight" and "Taillight," from	...	12/- ,,
Festoon and Fairy Lamps	...	18/- ,,

Lighting Flex, 14-36, 13s. 6d. per gross yd.
Cable, 1/18, 7s. per coil; 3/32, 8s. 6d. per coil.
B.C. Holders, 4s. 6d. per doz.; 5-amp. P.B. Switches, 5s. 6d. per doz.
Ceiling Roses, 30s. per gross.
Pin-grip Fittings, Tubing, &c., lowest prices.
Electrical Universal Travelling Irons, 7s. 6d. each.

Cash with order; carriage paid above £3. Prices quoted for quantities. See our announcement in this issue re Valves and Wireless.

NORWOOD WHOLESALE FITTINGS SUPPLY CO., LTD.,
71, High Street, South Norwood, S.E.25. 'Phone: Croydon 937.
3499

MOTOR GENERATORS FOR SALE.

10 kW, 500 volts, d.c. to 110 volts, d.c.,	£50.
10 kW, 440 volts, a.c. to 220 volts, d.c.,	£65
30 kW, 480 volts, d.c. to 80 volts, d.c.,	£100
40 kW, 200 volts, a.c. to 220 volts, d.c.,	£120
75 kW, 440 volts, a.c. to 500 volts, d.c.,	£200
90 kW, 480 volts, d.c. to 110 volts, d.c.,	£210
200 kW, 440 volts, a.c. to 220 volts, d.c.,	£900

Several others; also Rotary Converters up to 850 kW.
FYFE, WILSON & CO., LTD., 31, Budge Row, London, E.C.4.
3518

SMALL STEAM SETS FOR SALE.

26 kW, 105 volts, d.c.	£100
30 kW, 220 volts, d.c.	£130
40 kW, 220 volts, d.c.	£150
55 kW, 230 volts, d.c.	£185
75 kW, 220 volts, d.c.	£250
150 kW, 230 volts, d.c.	£300

Many larger.
FYFE, WILSON & CO., LTD., 31, Budge Row, London, E.C.4.
3519

A.C. MOTORS FOR SALE.

SIX 130-h.p., 415-volt, 50-cycle, 3-phase, 500 r.p.m. Slip ring Motors, by the Lancashire Dynamo Co., Ltd., with oil-immersed control gear. Very cheap. Also 150, 200, 220, 250 and 450 h.p. ditto.—Fyfe, Wilson & Co., Ltd., 31, Budge Row, London, E.C.4.
3517

FOR SALE.—*Continued.*

VALVES IN STOCK—GUARANTEED.

FOUR-Electrode Valve for New Unidyne circuit to work sets without h.t. battery	8/6 each
Dutch Valves, soft and hard, R. type	3/10 ,,
Ditto, tubular, horizontal	3/3 ,,
French Valves, R. type	5/9 ,,
(All faulty valves exchanged. Minimum quantity sold one dozen.)	
Headphones, large N. & K. type	9/9 each
Ditto, small N. & K. type ... A. 7/6 each; A-1	9/3 ,,
Ditto, Dr. Nesper adjustable	10/3 ,,
Ditto, The Norwood adjustable	8/6 ,,
Aerial Wire, 100-ft. coils, hard drawn copper ...	16/- doz.
Coil Holders, 2-way	2/6 each
Ditto, 3-way	3/6 ,,
Flex, 14-36 ... ... per gross yd.	13/6
H.T. Batteries, complete with Wander Plugs, 60-volt	5/3 ,,
Ditto, 15-volt	1/6 ,,
Pocket Lamp Batteries	3/6 doz.
Adhesive Tape	1/1 per lb.

Crystal Sets, Sloping Cabinet, Dust-proof Detector, 10/6 each
Cash with order; carriage paid above £3. Everything for wireless. Write, or 'phone Croydon 937.

NORWOOD WHOLESALE FITTINGS SUPPLY CO., LTD.,
71, High Street, South Norwood, S.E.25.
See our announcements *re* Electric Lamps and Fittings.
3498

THOMSON, PATRICK, LTD.,
10 & 12, Hart Street, Liverpool.
Tel.: Royal 4267.

D.C. MOTORS.

H.P.	Volts.	Revs.	Make.	Price.
100	230	300	Bruce Peebles	£100
30	230	700	Crompton	45
20	230	740	Bruce Peebles	35
15	230	700	Bruce Peebles	25
15	230	750	Lancashire Dynamo	25
12	230	720	Bruce Peebles	20
5	230	750	Bruce Peebles	16

A.C. MOTORS, 3 PHASE, 50 CYCLE.

H.P.	Volts.	Revs.	Make.	Price.
80	440	720	Harding Churton	£140
50	440	960	Harland Eng.	60
7½	440	1400	Howells	16
1	200	1400	G.E.C.	4

Five Ventilating Fans, Porthole, 18", 230 V, £5 each.
One Ventilating Fan, Porthole, 24", 230 V, £7.
One Ventilating Fan, Porthole, 12", 460 V, £4 10s.
One Electric Truck (Roadcraft), Price £50.
One House Lighting Set, 65/70 volt, 25/30 amps., Price £30.
8785

30,000-VOLT GEAR FOR SALE.

15 SINGLE-Pole Isolating Switches, 200 amps., by Westinghouse.
Six single-pole Isolating Switches, 300 amps., by Westinghouse.
(All suitable for wall mounting.)
26 Through Insulators with fittings, by Westinghouse.
62 Through Insulators without fittings, by Westinghouse.
129 Blind Insulator Supports with fittings, by Westinghouse.
65 Blind Insulator Supports without fittings, by Westinghouse.
Three 3-phase, 10-amp., 50-cycle Reactances, to give 800 volts choke per leg, by B.E.T.
Two 300-amp., 3-pole Oil Switches, complete with 4 C/Ts 50/5.
Two C/Ts 10/5, 2 Time Limit Relays, 2 Slate Panels and Gear.
Two Ammeters and 2 Choke Coils, all by Ferranti.
All new, in makers' original cases.—3418, Electrical Review, 4, Ludgate Hill, London.

NOTTINGHAM.

FOR Sale, that important modern white building, corner of Carrington Street, facing Woolworth's; buying centre. 20,000 or 25,000 feet floor space, 160 frontage. Palatial rooms; large workshops.
NOTE.—Light car commercial transport vehicle Corporation desire to rent part of ground floor only as central Midland show depôt.
Remainder of block offers opportunity to Electric Corporation for showrooms or Motorists' Mutual Club. Ladies' and gents.' toilet rooms complete. Motorists' tailoring. Costumier's. Fancy goods. Wines and Spirits. Department Supply Stores. "Mutual Advantage Combine" to members only.
Personal application necessary for arranging best terms with
RICHARD BAVIN & CO.,
3591 Estates Offices, Nottingham.

WHITEHAVEN CORPORATION ELECTRICITY DEPARTMENT.

Plant for Sale.

250-KW Browett Lindley-Phœnix Steam Generating Set, 440 volts, d.c., 150 lb. sq. in.; in excellent running order.—Full particulars can be obtained from the Borough Electrical Engineer, Whitehaven.
3465

FOR SALE.—*Continued.*

PLANT FOR SALE.

THE Shoreditch Borough Council, Electricity Department, invite offers for the following Electric Generating Plant, together with certain Steam Pipes, which are for sale:—

One Willans Engine and E.C.C. Electric Generator (direct-coupled), including stop and exhaust valves.
KW 165, d.c.
Volts 500.
Speed 350 r.p.m.

One ditto—
KW 165, d.c.
Volts 150 to 165.
Speed 350 r.p.m.

One Direct Current Transformer,
Primary 1,000 to 1,100 volts.
Secondary, 150 to 165 volts.
Amperes 365 to 400.

The plant is in working order, and may be seen upon application at the Council's Electric Power Station, Whiston Street, Haggerston, E.2.

Tenders must be delivered at the address given below not later than noon on Wednesday, the 9th July next, and should be made on the official form, copies of which can be had, with further particulars and conditions of sale, from the undersigned.

C. NEWTON RUSSELL,
Borough Electrical Engineer.

Electricity Supply Department,
Coronet Street, Shoreditch, N.1.
June, 1924. 3570

FOR SALE.

Generating Plant, 220/240 volts, d.c.
One 100-kW Generator, 325 r.p.m., coupled direct to a four-cylinder oil engine.
Two 40-kW Generators, 350 r.p.m., coupled direct to two cylinder oil engines.
Three Generator Panels for the above with switches and circuit breakers.
Five 200-amp. Feeder Panels with switches and circuit breakers.
One Motor-driven Air Compressor.
8769 J. A. ANDERSON, 1, Eldon Square, Newcastle-on-Tyne.

URGENT—SPACE REQUIRED.

£1,750 is the price of 1,000-kW (two 500-kW) Parsons Turbine Generating Sets, 230 volts, d.c., with Klein condensing plant and spare armature complete; steam 150 lb. Also available 600-kW Brush-Parsons Exhaust Turbine Set, 230 volts, d.c., and E.C.C.-Willans Exhaust Turbine Set, 200-kW, 460 volts, d.c.—Jennings, West Walls, Newcastle-on-Tyne. 6

Advertisements are inserted under this heading at 1s. 9d. per line.

A LARGE quantity of Electrical Generating Plant at the Christchurch Generating Station of the Bournemouth and Poole Electricity Supply Co., Ltd., will be available for disposal.—Enquiries for a schedule of the plant should be addressed to Bournemouth and Poole Electricity Supply Co., Ltd., Bournemouth. 3554

A LARGE quantity of M.F. Lamps always in London stock. All standard voltages and wattages. 12s. per dozen. Special prices for quantities. No infringement. Send for price list. Every lamp guaranteed.—C. D. B., 186, High Holborn, W.C.1. 3481

ADHESIVE Tape, fine quality English made, Connolly Bros. make; ½-in., ¾-in., and 1-in.; perfect condition. Sample 3 rolls, any size, 2s. 6d., post paid; 14-lb. lots, 1s. 1d. lb.; 1 cwt. lots, 1s. lb.—Edwardes Bros., 20, Blackfriars Road, London. 8814

ALLEN High Speed Enclosed Compound Steam Engines, 315 h.p., 400 revs., 200 h.p., 375 revs.—Harry H. Gardam and Co., Limited, Staines. 3387

ALTERNATORS, 50/90 kW. Brand new Siemens, 200/520 volts, three-phase, 40/50 periods, complete with exciters and switchboards, for sale very cheaply.—Farrow, Spalding. 21

AT 9, Colonial Avenue, Minories, E.1, near Aldgate Station, stocks of d.c. and a.c. Dynamos, Motors, Batteries, Cable, Tape, Wire, Electric Drills and Wireless Sets are kept. —Leslie Dixon & Co. Tel. No., Avenue, 4166. 4

AUSTIN Lighting Sets, 35 volts, 20 amps.; guaranteed. 80-volt, 120-amp. Electromotors Compound Dynamo; cheap.—Cole, 457, Rathgar Road, Loughborough Junction, S.W.9. 8668

AUSTIN 8-kW Petrol-driven Lighting Set, two-cylinder engine; compound dynamo; on cast-iron bedplate; with switchboard.—Thomas Mitchell & Sons, Ltd., Bolton. 3551

FOR SALE.—*Continued.*

BELLISS Enclosed High Speed Compound Steam Engines, 550 h.p., 290 h.p., 125 h.p., 100 h.p., and 40 h.p.—Harry H. Gardam & Co., Limited, Staines. 3386

BELLISS-FOWLER 100-kW Generating Set, 130 lb. steam pressure, 420/450 volts, shunt wound; complete with switchgear. Thorough working order.—Borough Electrical Engineer, Bury St. Edmunds. 3484

BOILER Scalers, electric, 230-V and 110-V, d.c., complete with flexible shaft and tool heads, ready for work; cheap.—T.P., Ltd., 10, Hart Street, Liverpool 8786

CABLE, approx. 220 yards of 91/.118 s.w.g. paper insulated, lead-covered, for sale.—Offers to 8752, Electrical Review, 4, Ludgate Hill, London.

CABLE, highest quality, best British makers, Silvertown, Henley, Hooper, Callender, Glover, Liverpool Cable Co., 19/050, 7/16, 7/18, 7/22, 7/24, less than half values. Samples sent.—Lake, 44/47, Devonshire Street, Theobalds Road, London, W.C.1. 8620

CARBONS, all classes, including flame, open, &c.; half price.—The London Electric Firm, Croydon. 3363

CLEATS and Insulators, porcelain, large variety, cheap.—Edwardes Bros., 20, Blackfriars Road, London. 8818

C.T.S. Cables, new single, twin and three-core, large stocks, best makes; cheap.—Edwardes Bros., 20, Blackfriars Road, London. 8816

DYNAMOS by Crompton, 250-amp., 110 volts, 900 r.p.m., enclosed 4-pole type, compound and shunt coils; first-class condition. £50.—Groves & Co., Engineers, Watford. 3541

ELECTRO-Generator Co., 1a, Shepherds Bush Road, W.6. Supply or hire, trade or user, Electro Motors, Dynamos, Generating Sets. Experienced staff for repairs, maintenance, installations, rewinds; advice and quotations free. 'Phone, Hammersmith 488. 8091

ELECTRIC Lighting Plant for Sale.—For immediate disposal, 12 miles from London (Surrey), private electric lighting plant, consisting of 4½ b.h.p. National gas engine, 50/75-volt dynamo, switchboard and 27 cells. The whole is in good condition. The plant was installed by one of the leading firms in London in 1917. This is an exceptional bargain and highly recommended. Price for quick sale as it stands, eighty guineas.—John A. Cook (West of England Representative for Ruston & Hornsby, Ltd.), 5, Elton Road, Bishopston, Bristol. Telephone 757. Telegrams, "Exhaust Bristol." 3585

ELEVEN new 30-kW, 220-volt Gardner-L.D. & M. Co. Paraffin Generating Sets. Low price.—Fyfe, Wilson and Co., Ltd., 31, Budge Row, London, E.C.4. 3439

EXCELLENT 34-h.p. National Gas Engine, magneto type, No. 29350, £110 on rails. Bargain.—3470, Electrical Review, 4, Ludgate Hill, London.

FOR Sale, 500-kW, 240-volt, d.c. Bellise-British Thomson-Houston triple-expansion Set for 160 lb. steam pressure, guaranteed sound. £800.—Fyfe, Wilson & Co., Ltd., 31, Budge Row, London, E.C.4. 3443

FOR Sale, Lalley Light Plant, complete with switchboard. £35.—Fyfe, Wilson & Co., Ltd., 31, Budge Row, London, E.C.4. 3444

FOR Sale, in whole or part, complete Power House Plant, suitable for colliery, and consisting of 30 ft. by 8 ft. Lancashire boilers for 160 lb. w.p. Two 325-kW, 500-volt, d.c. Steam Sets, with condensing plant, switchboard, &c.—Fyfe, Wilson & Co., Ltd., 31, Budge Row, London, E.C.4.— 3437

FOR Sale, large Electrolytic Generator, 7 volts, 2,500 amps., 300 r.p.m.—Fyfe, Wilson & Co., Ltd., 31, Budge Row, London, E.C.4. 3438

FOR Sale, 800-h.p. vertical enclosed triple-expansion Engine, by Belliss & Morcom; also ditto by Howden. Price £600 each.—Fyfe, Wilson & Co., Ltd., 31, Budge Row, London, E.C.4. 3440

FOR Sale, two nearly new 500-kW, 230-volt, 200 r.p.m. single-bearing engine type Generators, by British Thomson-Houston Co., Ltd.; 1917. £400 each.—Fyfe, Wilson and Co., Ltd., 31, Budge Row, London, E.C.4. 3441

FOR Sale, two 150-h.p. Garrett semi-stationary, compound super-heated Condensing Sets, insured for 190 lb. steam pressure, complete with jet condenser and 100-kW, 460-500-volt, d.c. generator, with Renolds chain drive gear, also panels. The above plant was installed new in 1916, and forms a very efficient and compact equipment. Price £2,000 the lot.—Fyfe, Wilson & Co., Ltd., 31, Budge Row, London, E.C.4. 3434

FOR Sale, one 3,000-kW Turbo Alternator, 2,200/2,400 V, periodicity 100, 3,000 revs., steam 160 lb., with condenser, &c.—3424, Electrical Review, 4, Ludgate Hill, London.

FOR SALE.—*Continued.*

FOR Sale or Hire, Motors and Dynamos, 440, 220, 110 volts.—Martin, 320, Witton Road, Birmingham. 'Phone: East 883. 7

FOR Sale, Three Belliss & Morcom direct-coupled Generating Sets, each 100-kW, with condensing plant, switchboard, &c., all in first-class condition, and can be seen running. Also Stirling Boiler, suitable for working pressure of 200 lb.—3534, Electrical Review, 4, Ludgate Hill, London.

FOR Sale, Silvertown Portable Wheatstone Bridge Testing Set, as new; what offer.—Robertson, Sneddon, Paisley. 8760

FOR Sale, Motor-Generator by Siemens, 440-volt, 50-cycle, 3-phase motor, coupled to 75-kW, 500-volt, d.c. generator complete with control gear; £215.—Fyfe, Wilson & Co., Ltd., 31, Budge Row, London, E.C.4. 3595

FOR Sale, two 700-kW, 500-volt, d.c. Diesel Engine Sets, complete with auxiliaries. Very cheap.—Fyfe, Wilson and Co., Ltd., 31, Budge Row, London, E.C.4. 3522

FOR Sale, 1,250-kW, 3,300-volt, 50-cycle, 3-phase Turbo Set, by B.T.H. Co., with condenser, &c. Cheap.—Fyfe, Wilson & Co., Ltd., 31, Budge Row, London, E.C.4. 3523

GREEN'S Economiser, 384 tubes, 1916, 200 lb.—Harry H. Gardam & Co., Limited, Staines. 3388

INCREASE your winter sales by selling "Eagle" Pocket Lamp Batteries, Cases, Bulbs, and Electrical Novelties. Our prices defy competition.—Engineering Supplies, 155a, Upper Thames Street, E.C. 3569

LARGE stocks of Electric Generating Sets, by Austin, Gardner, Parsons, &c., for cinemas, welding, stand-by plant, house lighting, &c., from 1 to 100 kW.—Fyfe, Wilson and Co., Ltd., 31, Budge Row, London, E.C.4. 3435

LIGHTING Plants, Petter Varitys, 50/70 V, 1½ kW, new. £49 each.—White, 47a, Pomeroy Street, New Cross. 8328

MOTOR-Driven Air Compressor for sale, 1,000 cubic feet per minute, 100 lb. per sq. in., with 500-volt, d.c. motor.—Fyfe, Wilson & Co., Ltd., 31, Budge Row, London, E.C.4. 3436

MOTORS for Sale, all d.c., 220 volts, 20 h.p., 870 r.p.m.; 35 h.p., 800 r.p.m.; 30 h.p., 600 r.p.m.; 25 h.p., 640 r.p.m.; 25 h.p., 600 r.p.m.; 50 h.p., 500 r.p.m.; 50 h.p., 850 r.p.m.; 85 h.p., 380 r.p.m.; all complete with switches and starters; can be seen running.—Particulars from F. and R. H. Kirkup & Co., Pilgrim Street, Newcastle-on-Tyne. 8687

NAMEPLATES in Metal, Ivorine, &c. Stencils for Signs. —Stilwell & Sons, 7, Jordan Well, Coventry. 7940

NEW Cables, 3/22, doubly taped, V.I.R., 2,500-meg. grade, red or black, 8s. 9d. per 110 yd.; 7/.029 braided V.I.R., 15s. per 110 yd.; 7/14 ditto, 65s. per 100 yd.; 37/28 ditto, equal to 7/20, 13s. 6d. per 100 yd.; 19/16 ditto, 95s. per 100 yd.; 19/17 ditto, 92s. 6d. per 110 yd.; 19/18 ditto, 75s. per 110 yd. All new and C.M.A. makes. Also large assortment C.T.S. and lead-covered Cables; cheap.—Edwardes Bros., 20, Blackfriars Road, London. 8806

NEW 10-h.p. air break Star Delta Starter, 440-V, 3-phase, 50-p., no volt, and 3 overloads; £7.—T.P., Ltd., 10, Hart Street, Liverpool. 8789

OIL Engine, vertical (Kelvin), 6-7 h.p., cold starting, petrol or paraffin, throttle governed. Nearly new, complete in detail. £30.—Groves & Co., Engineers, Watford. 3542

OIL Switch, new, 2,000 amps., 3-phase, 400 volts, 50 periods, by "Park Royal."—T.P., Ltd., 10, Hart Street, Liverpool. 8788

ONE Shunt-wound Dynamo by the McFarlane Engineering Co., output 50 amps. at 350-volt, speed 900 r.p.m., complete with slide rails and pulley. Machine guaranteed to give 55 amps. continuously. In splendid condition, practically new. —3557, Electrical Review, 4, Ludgate Hill, London.

OSRAM, Mazda and Ediswan Lamps, new, ½ watt, voltages 240, 205, 115, 110, 50, and 12; wattage 40, 100, 200, 300, and 500, at 45 per cent. off list prices. Metal filament 50 V, 30 W; 60 V, 10 W; 65 V, 20 W; 70 V, 30 W; 110 V, 20 W; 115 V, 15 and 100 W; 120 V, 10, 20, and 30 W; 210 V, 30 and 100 W; 250 V, 30 and 100 W; 260 V, 30 W; less 50 per cent. off list.—Edwardes Bros., 20, Blackfriars Road, London. 8807

PRESSES, Hydraulic steam-heated, 8-in. rams, 20-in. travel, 12 hot plates, 3 ft. by 3 ft., telescopic fittings, 6 ft. 8 in. daylight; cheap.—T.P., Ltd., 10, Hart Street, Liverpool. 8787

SCRAP Mica (cuttings and stampings) for sale, in perfect condition.—3555, Electrical Review, 4, Ludgate Hill, London.

SEMI-Stationary locomobile-type Steam Engine by Garrett, 140/180 h.p., compound condensing, superheated, with economiser, separator, &c. Modern.—Harry H. Gardam and Co., Limited, Staines. 3472

STEAM Generating Set, 5½-kW, 105-V, ditto 65-V, 27-A; 20 h.p. motors, 220-V, compound 750/1,250 r.p.m. (list). —E. Binns, 29, Church Road, Gosforth, Newcastle. 8751

FOR SALE.—*Continued.*

SURFACE Condensing Plant, new 1918, 8,400 lb. steam per hour, 350 sq. ft. cooling surface. Ditto, 33,000 lb. steam per hour, 3,500 sq. ft. cooling surface.—Harry H. Gardam and Co., Limited, Staines. 3384

TUMBLER Switches, 10-amp. P.B., new, 8s. 6d. doz. post free.—Edwardes Bros., 20, Blackfriars Road, London. 8815

TWO low-pressure Turbo Alternator Sets, each 1,050 kW, with Contraflo surface condensers, 6,000 volts, 3-phase, 50 periods. Low price.—Harry H. Gardam & Co. Limited, Staines. 3471

TWO 24 in., 220-V, d.c. exhaust Fans, £8.—8801, Electrical Review, 4, Ludgate Hill, London.

TWO 220-volt, 40-kW, Lancashire dynamos, 350 r.p.m., £160 each.—Chick, Skin Market Place, S.E.1. 8773

TWO New Double Leather Engine Belts, pure dressed, cemented and wood pegged, lined inside with canvas, each 81 feet long, 24 inches wide, 14 mm. thick, never been used; 4 cwt. each.—Best offer to Howard & Bullough, Ltd., Accrington. 3547

TWO 220-volt Lancs. Dynamos, 350 r.p.m., 187-ampere; perfect; £160 each.—Chick, Skin Market Place, Southwark, S.E.1. 8746

VOLTMETERS, moving coil, by Elliott, portable sub-standard, ranges 0/150/300/600 volts, self-contained, new condition guaranteed, 95s. nett. Meter and instrument repairs of every description.—The Victa Electrical Co., 47, High Street, Battersea, S.W. 942

WEIR Boiler Feed Pump, steam cylinder 8 in., water 6½ in. by 18 in. stroke. Ditto 10 in. by 7 in. by 13 in. stroke.—Harry H. Gardam & Co., Limited, Staines. 3385

WIRELESS rubber-covered Flex, 23/36, copper strands, C.M.A. make, new; 7s. 9d. per 100-yd. coil, post free.—Edwardes Bros., 20, Blackfriars Road, London. 8808

1/16 V.I.R. C.M.A. Cable, new, 16s. per 220 yds.; 3/18 V.I.R. C.M.A. Cable, new, 26s. per 220 yards.—T. M. Colquhoun & Co., 37, Canning Street, Glasgow. 3593

1/16 V.I.R. taped and braided Cable. Enfield-Ediswan make; new. 8s. 3d. per 110-yd. coil.—Edwardes Bros., 20, Blackfriars Road, London. 8809

3/20 V.I.R. taped and braided Cable, "Helsby," "Johnson & Phillips" make, new; 11s. 6d. per 110-yd. coil.—Edwardes Bros., 20, Blackfriars Road, London. 8810

7/16 V.I.R. taped and braided Cable, English make, 600-meg. grade, new; 45s. per 110-yd. coil.—Edwardes Bros., 20, Blackfriars Road, London. 8811

7/18 V.I.R. taped and braided Cable, English make, 600-meg. grade, new; 25s. per 110-yd. coil.—Edwardes Bros., 20, Blackfriars Road, London. 8812

19/14 NEW V.I.R. taped and braided Cable, best English makes, approx. 30-, 40- and 50-yd. lengths; £7 per 100 yd.—Edwardes Bros., 20, Blackfriars Road, London. 8817

4-H.P., slow-speed, a.c. Motor, by Westinghouse, 3-phase, 50 cycles, 400/440 volts, 565 revs., squirrel cage.—Thomas Mitchell & Sons, Ltd., Bolton. 3549

15-H.P., d.c. Motor, by Siemens, 220/250 volts, 965 revs., 4 poles and interpoles; starter.—Thomas Mitchell and Sons, Ltd., Bolton. 3548

15-KW, 220-volt Crompton Dynamo, £35. Only run 3 weeks. 10-kW Aster Dynamo, 220 volts, £22; good order. 8/10-kW, E.C.C. Dynamo, 80/100 volts, first class, £19.—Chick, Skin Market Place, Southwark, S.E.1. 8747

16-KVA, 110-volt, 50-per., 1-phase Alternator.—Greenhalgh Bros., Atherton, Nr. Manchester. 2141

20-H.P., a.c. Motor, by Wright & Wood, 3-phase, 400 volts, 725 revs., squirrel cage; Ellison starter.—Thomas Mitchell & Sons, Ltd., Bolton. 3550

20-KW, 100/150-volt, d.c. Dynamos (3), modern design, low price.—Harry H. Gardam & Co., Limited, Staines. 3390

26-KW, 100/160-volt, petrol-paraffin B.T.H.-Parsons Generating Set. New.—Midland Counties Electrical Eng. Co., Ltd., 136, Sandon Road, Birmingham. 3566

37-KW, 460-volt, d.c. Dynamos, complete. Practically unused.—Harry H. Gardam & Co., Limited, Staines. 3391

60-KW, 220/240 volts, 850 revs., by Rhodes, with Switchboard.—Greenhalgh Bros., Atherton. 1072

100-KW, d.c. Generator, 500 V, direct-coupled to Belliss and Morcom Steam Engine, available immediately, for quick sale at bargain figure.—Richards, Stafford House, Trentham Road, Longton. 1

125-KW, 125-volt, d.c. Allen Steam Generating Sets. Low price.—Harry H. Gardam & Co., Limited, Staines. 8817

FOR SALE.—*Continued.*

170-KW, 80-kW, and 60-kW, 220-volt, d.c. Dynamos. Complete, and as new.—Harry H. Gardam & Co., Limited, Staines. 3319

200-KW, 230-volt, d.c. Allen Steam Generating Sets (three), modern design. Low price.—Harry H. Gardam & Co., Limited, Staines. 3318

10,000 METAL Filament Low Voltage "Z" Lamps. 100, 105, 110 and 115 volt, various wattages. 6s. per dozen. Carriage paid. Usual guarantee.—3581, Electrical Review, 4, Ludgate Hill, London.

25,000 CARBON Filament Lamps, "Ring" make, 120, 200, 210, 220, 250, and 225 volts; 8, 16, 25, 30, and 50 c.p.; new. Sixty per cent. discount off makers' list price.—Edwardes Bros., 20, Blackfriars Road, London. 8813

ARTICLES WANTED.

Advertisements are inserted under this heading at 1s. 9d. per line.

BATTERIES (Storage), old Dynamos, Transformers, Arc Lamps, Electric Meters, Scrap Cable, Metals or Machinery of any description purchased. Distance no object. —A. Learoyd & Son, Bridge Works, Heatherley Street, Clapton, London. Telephone: Dalston 2278. Tele. address: "Frangible, Lowclap, London." Established 1860. 8039

MOTORS wanted, two 2 h.p., 200-volt, two 3 h.p., 200-volt, two 4 h.p., 400-volt, all S.E., about 800 r.p.m.—Somerset, Bank Street, Hulme, Manchester. 3582

ONE or two second-hand 48 in. to 60 in. Ceiling Fans, 220 volts, d.c.—Engineer, Electricity Works, S. Farnborough, Hants. 8764

TELEPHONE Cable wanted. Government surplus rubber insulated, centre of this steel strands. Large quantities required.—3360, Electrical Review, 4, Ludgate Hill, London.

WANTED, one 500-amp. three-pole Ironclad switch, 65 yds. 91/.103 V.I.R. cable.—T. M. Colquhoun & Co., 37, Canning Street, Glasgow. 3592

WANTED, the undermentioned plant or the nearest size thereto, viz.: One 200-kVA, 400-volt, 3-phase, 50-period Alternator, complete with exciter.—State speed, and whether suitable for belt drive, age, where it can be inspected, and lowest price, &c., to 3507, Electrical Review, 4, Ludgate Hill, London.

£22 per oz. given for Platinum Scrap, in large or small quantities. Call and be convinced before selling elsewhere. Parcels by post, prompt cash per return. The original firm.—The Depôt, 47, Charing Cross Road, London, W.C.2. 8622

AGENCIES.

Advertisements are inserted under this heading at 14s. per inch.

NEW ZEALAND.

THE Representative of one of the most influential firms in New Zealand is visiting London for the specific purpose of securing Sole Agencies for the sale of general electrical equipment, for generation, transmission, and lighting and power purposes.

Will manufacturers interested address communications to—

Box 3575, Electrical Review, 4, Ludgate Hill, London.

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A REPRESENTATIVE now working a long established connection with the most important industrial firms throughout the country can obtain a direct, and later possibly sole interest in a well-known and old-established electrical business. This proposition will only interest gentlemen with exceptional facilities in approaching the "Men that matter." —3562, Electrical Review, 4, Ludgate Hill, London.

AGENCIES wanted by old-established wholesale firm in South Wales, with sixteen years' connection amongst collieries, works, and the trade, for dynamos, motors, cables, and switchgear.—8758, Electrical Review, 4, Ludgate Hill, London.

AGENTS required (provincial centres) by well-known firm manufacturing high class electrical instruments.—Full particulars to 3532, Electrical Review, 4, Ludgate Hill, London.

AGENCIES.—*Continued.*

FIRST-Class firm of industrial fittings manufacturers specialising in street lighting equipment, reflectors for works, factories, &c., desire to appoint an agent for South Wales. Preference given to one with established connection among station engineers and important works. Commission only.—3584, Electrical Review, 4, Ludgate Hill, London.

FOREIGN Agencies may be quickly obtained by advertising in Foreign papers.—Rates, &c., from Deacon's British and Foreign Advertising Agency, 7, Leadenhall Street, London. 3417

MANAGING Director of established, well rated, Electrical Distributing Company in British Columbia, now on a short visit to the Empire Exhibition, desires to represent manufacturers of accessories, cables, lighting fittings, appliances, novelties, or anything of interest to the commercial and residential purchaser.—Please write immediately, giving fullest particulars, to 8754, Electrical Review, 4, Ludgate Hill, London.

MANUFACTURERS' Agent required who will be prepared to carry large stocks of Ironclad switch and fusegear, manufactured by a well-known firm. This is a good opportunity for a real live, energetic man, well-known upon the North-East Coast and operating from Newcastle-upon-Tyne.—3589, Electrical Review, 4, Ludgate Hill, London.

SOUTH Wales.—Engineer (A.M.I.E.E.), wishes to represent manufacturers of electrical apparatus for collieries, works, and the trade. Good connection, over number of years. —8757, Electrical Review, 4, Ludgate Hill, London.

WELL-Known London firm of engineers, with extensive home and foreign connections (maintaining overseas branches), desires Agency for motors, control gear, and one or two other electrical manufactures of high quality.—Only firms of first-class reputation will be considered, and communications should be sent in the first instance to 8699, Electrical Review, 4, Ludgate Hill, London.

PARTNERSHIPS.

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ELECTRICAL Engineer is desirous of purchasing interest in thoroughly established concern after fullest investigations, £2-3,000.—8803, Electrical Review, 4, Ludgate Hill, London.

WHOLESALE London firm holding two valuable agencies, with a turnover of £25,000 per annum, of which one-third is export, is disposed to consider possibility of amalgamation with similar houses, with view to economies, especially as the tendency to-day is towards combination of interests amongst manufacturers.—Confidential correspondence to 3599, Electrical Review, 4, Ludgate Hill, London.

WORKSHOPS, PREMISES AND SITES TO LET OR WANTED.

Advertisements are inserted under this heading at 14s. per inch.

SALE OF FREEHOLD LAND IN BOOTLE.

TO ENGINEERS, CONTRACTORS, AND OTHERS.

For Sale by Private Treaty.

One of the few remaining Plots of Freehold Land in this District.

THE Land is situated in Knowsley Road, Bootle, adjoining the London, Midland and Scottish Railway, with frontage on a main arterial road, and upon it is erected Factory Premises known as the Knowsley Electrical Works, and until recently in the occupation of James Scott, Ltd. (In Voluntary Liquidation.)

The property comprises Factory Premises, General and Drawing Offices, Stores, Garage (with pit), 3 Cottages and sundry Outbuildings, together with a piece of vacant land, and covering in all a total area of 3,809 square yards, or thereabouts.

The premises are well lighted, and could be adapted for various uses. Part of the building is steamheated, and fitted with racks, &c., suitable for the storage of small parts. Entrances for vehicles are in existence in both parts of the property, and facilities for the erection of a hoist are already in existence.

For order to view and further particulars apply to

PATERSON & THOMAS,
14, COOK STREET, LIVERPOOL.

In addition to the foregoing, the Glasgow properties of the above Company are for disposal. They are situated in Crawford Street and Rae Street, Port-Dundas, Glasgow, and comprise Factory Premises and Engineering Workshop, Foundry, Offices, and sundry Outbuildings, covering in all an area of 3,405 square yards.

The major portion of this lot is offered with immediate vacant possession. For full particulars, apply to McClure, Naismith, Brodie & Co., 77, St. Vincent Street, Glasgow; or to Chalmers, Wade and Co., 5, Fenwick Street, Liverpool. 3564

BUSINESSES FOR SALE AND WANTED.

Advertisements are inserted under this heading at 1s. 9d. per line.

CONTRACTOR'S Business for Sale—showroom and front retail shop. Wireless, &c., fully equipped. Living accommodation; telephone installed. After full investigation best offer accepted. Birmingham district.—3535, Electrical Review, 4, Ludgate Hill, London.

ELECTRICAL and Contracting Engineers, main road, S.W., d.f. shop, no opposition, stock £400; genuine bargain, newly decorated, long lease, small rent; £750 or offer.—8711, Electrical Review, 4, Ludgate Hill, London.

EXCEPTIONAL opportunity to secure Garage, Electrical and Wireless business in Sheffield; speciality armature winding, 6 employés kept; any investigation to genuine applicants; 6 years' lease to run; suit partners or company; excellent living accommodation, just been decorated throughout; ill-health cause of sale. £1,000 includes goodwill, machinery, tools, fixtures, &c. Stock at valuation.—8756, Electrical Review, 4, Ludgate Hill, London.

WIRELESS and Electrical lock-up Shop. Midland town. No competition. Takings this year to June 14th, £1,028 16s. 9d. Genuine. £100, stock at valuation (about £450). Gift. No offers; proprietor leaving district. Investigation. Urgent.—8784, Electrical Review, 4, Ludgate Hill, London.

MISCELLANEOUS.

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COIL Winding.—Work wanted; prompt deliveries; competitive prices.—Send particulars of your requirements to 1993, Electrical Review, 4, Ludgate Hill, London.

ENGINEERING. Do you know that the weekly private paper called "The Engineers' and Apprentices' Employment Gazette" can really help you to get a good job?—Write for free specimen copy, stating the type of job you require, to the Technological College, 331W, Strand, London, W.C.2. 3563

SECOND-Hand Plant examined for purchase.—British Engine, Boiler & Electrical Insurance Co., Ltd. See p. xli. 5

SIGNS.—Glass Duplex Panels, process and sand blasted.—King Signs, Ltd., 23, Collingwood Street, S.E.1. 8011

EDUCATIONAL NOTICES.

Advertisements are inserted under this heading at 14s. per inch.

SECURE ADVANCEMENT through TRAINING BY POST in spare time NOW! Individualised Correspondence Tuition for

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Apply, mentioning requirements or Subject(s) of interest, for a **FREE copy of "U.E.C." PROSPECTUS No. 8, to:—**

SECRETARY'S DEPARTMENT (Desk A).

UNIVERSITY ENGINEERING COLLEGE, Westgate-on-Sea, Kent. 8793

SUBSCRIPTION RATES,

POSTAGE FREE:

United Kingdom, £1 14s. 8d.; Canada, £1 12s. 6d.; Colonial and Foreign, £2 1s. 6d. per annum.—NEW YORK: D. VAN NOSTRAND CO., 25, Park Place, New York City. TORONTO, ONT.: WM. DAWSON & SONS, LTD., Manning Chambers. PARIS: BOYVEAU AND CHEVILLET, Librairie, Etrangere, 22, Rue de la Banque.

THE ELECTRICAL REVIEW,

Publishing Office:

4, LUDGATE HILL, LONDON, E.C. 4.

Telegraphic Address: "Ageekay, Cent., London." A B C Code.
Telephone Nos.: Central 8260 and 8261.

FANS, 38/6 EACH.

FANS, 12", Trunnion, Swivelling, guaranteed brand new, beautifully finished, 38/6 each. Sample carriage paid.—COOKS, 79, Waterside, Lincoln. 8797

THE EASTERN TELEGRAPH COMPANY, LTD.

THE annual meeting (being the ninety-third ordinary general meeting) of the Eastern Telegraph Co., Ltd., was held on June 24th at Electra House, Moorgate. Sir John Denison-Pender, G.B.E., K.C.M.G. (chairman of the company), presided.

The CHAIRMAN said: Gentlemen, before proceeding to the ordinary business of the meeting, it is my sad duty to refer to the loss which this company has sustained recently by the death of two of your directors—Sir Albert J. Leppoc Cappel, who died after a brief illness on April 20th last, and Viscount Pirrie, who died on the 7th of this month.

At our last General Meeting I mentioned that firstly the trade depression which had so adversely affected our message receipts showed no signs of improvement, and that there was at that time a consistent decrease in traffic for which we must be prepared in the current year and, secondly, that the directors and administration were giving the matter their most careful consideration and were reviewing possible channels through which economies might be effected. These two statements have been realised, for the accounts now before you show a net reduction in gross revenue of about £437,000 against which, I am pleased to say, there has been the substantial reduction in the working expenses of £396,000, so that the net profit is only £41,000 less than the preceding year—a result which, in view of all the circumstances, I think you will deem satisfactory, for while we are still paying the same dividend as paid for the preceding four years, we have been able to make a contribution of £300,000 to the general reserve fund and to carry forward to next year's accounts £321,424, which is rather more than the sum carried forward in 1923.

Regarding this decrease of £437,000 in the company's revenue, a certain amount of this may be attributed to the re-opening of the Indo-European Telegraph Co.'s overland route to India, and the remainder to trade depression spread over the whole of the company's system.

The £300,000 which has been allocated to the general reserve fund out of the profits of the year has been charged out on the other side of the general reserve fund account on page 10 in respect of expenditure on new cables, &c., held in suspense, to which I referred at some length at our last meeting, but you will see by reference to the balance-sheet on page 9 that there still remains about £1,350,000 to be dealt with in future years. I must remind you that we have, in conjunction with the Eastern Extension Co., incurred the heavy expenditure of about 5¼ millions since the termination of the war on account of a new line of cables to the East and on important renewals to our existing sections to improve our service generally, of which sum this company only applied to its stockholders for £1,000,000.

It has again not been necessary to make any addition this year to the amount set aside in the past for investment fluctuation, as this account shows a surplus of £372,000.

On September 1st a new service of reduced rate telegrams was introduced, known as Daily Letter Telegrams. These messages are accepted on any week-day and are charged for at one quarter of the ordinary rate, delivery being effected after 48 hours from the time of handing in. So far as we are able to judge up to the present, they have had little adverse effect on the full-rate and deferred traffic. The time in transmission is now, I am glad to say, back to the pre-war standard, and in many cases considerably improved since that time.

I regret to inform you that we have recently found it necessary to cease operations in Turkey. A dispute has arisen over a sum of over £100,000 due for terminal rates at Smyrna during the hostilities between Turkey and Greece, and the amount is claimed by both parties. We have repeatedly conveyed our desire to pay over this sum, which has been provided for in our accounts, immediately to the rightful party to be settled by international arbitration. Neither country has agreed to this course, though the matter has been pressed through the Diplomatic channels. Turkey is proceeding against us in her country for the recovery of this amount, and Greece threatens to take similar action. Turkey has, however, closed our offices in her territory, and we have, therefore, had no alternative but reluctantly to terminate the engagement of the Turkish staff and withdraw from the country. I do not think, however, you need feel perturbed, as the present profit derived from the Turkish traffic, after paying expenses, does not materially affect our revenue either one way or the other, although on sentimental grounds we, of course, regret that associations which have been so cordial during practically the whole of the company's history should have been terminated, whether temporarily or permanently, through no fault of this company.

You are doubtless aware that the South American traffic of the Western Telegraph Co. is partially dealt with by this company, and for some time past messages to and from this destination exchanged with Paris and Northern France have been subject to considerable delay on the French land lines, thus placing the Associated Companies at a disadvantage when competing for South American traffic. This company, therefore, opened negotiations with France for obtaining a special wire between Paris and London, which up to the present has been refused. Representations have been made in the proper quarter, and we feel very strongly that as special wires are accorded by the British Post Office to the French Cable Co. competing in this country for South American traffic, corresponding facilities should be granted to a British company in France. We are, however, still pressing for this facility.

I suppose it is known to you all that practically all cables are what is called "duplexed," that is to say, that two messages pass over one copper wire in opposite directions at one and the same time. This new invention of super-imposing enables us to send an additional message at the same time in one direction, so that you have on one copper wire two messages going one way and one message coming the other way at the same time, thus providing a third channel on an existing cable with small additional expense. Had this remained in the experimental stage only I should not have mentioned it here to-day, but this is actually working on one of our Gibraltar-Malta cables, where it is carrying additional traffic very satisfactorily, and is now being installed on other cables of the Associated Companies. It also has the advantage that it will convey local traffic between two adjoining stations on a main-line route without interfering with the main-line through traffic which continues to pass at the same time.

Wireless competition with the Eastern Telegraph Co. is in operation between England and Egypt, between France and Indo-China and Madagascar, and between Holland and the Dutch East Indies. In the case of the three former countries the rates of charge are lower than those in operation by the cables, but so far the competition has not been such as to necessitate any reduction of our tariffs. With regard to Holland and the Dutch East Indies, the rates charged by the wireless and our cables are the same.

I now beg to move:—"That the printed report and accounts of the directors for the year ended December 31st, 1923, submitted to this meeting, be and the same are hereby received and adopted. That the dividend of 3½ per cent., less income tax, paid in respect of the preference stock of the company, and the dividend of 10 per cent., free of income tax, paid in respect of the ordinary stock of the company for the year ended December 31st, 1923, be approved."

The report and accounts were carried unanimously.

Causes and Cures for Dynamo "Diseases."

You will give more satisfaction, complete more work, and consequently earn more money, if you obtain

The Diagnosing of Troubles in Electrical Machines,

by Miles Walker, M.A., D.Sc., M.I.E.E.

A book containing a representative collection of the many troubles that may arise in electrical machinery and practical advice on the right method of correcting the faults.

Mr. L. Mercer, of Gt. Harwood, writes :—"*One of the best a man could wish for, dealing with the troubles in all electrical machines.*"

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You test a machine before you buy it, but take most books on trust. This one will be sent for

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To **The Library Press, Ltd.,**
83, Southwark Street, S.E.1.

Please send me "DIAGNOSING OF TROUBLES IN ELECTRICAL MACHINES." It is understood if the book does not satisfy me, I can return it on the 8th day, otherwise I will send a first payment of 3s. on the 8th day and 5s. per month for six months. (32s. net cash.)

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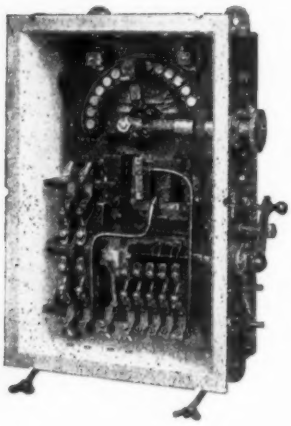

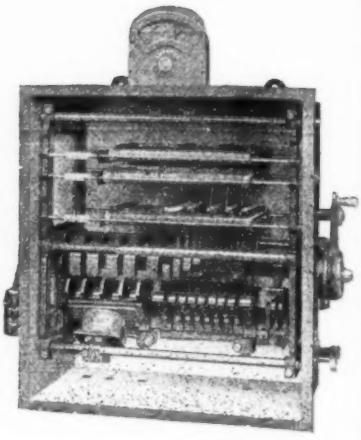

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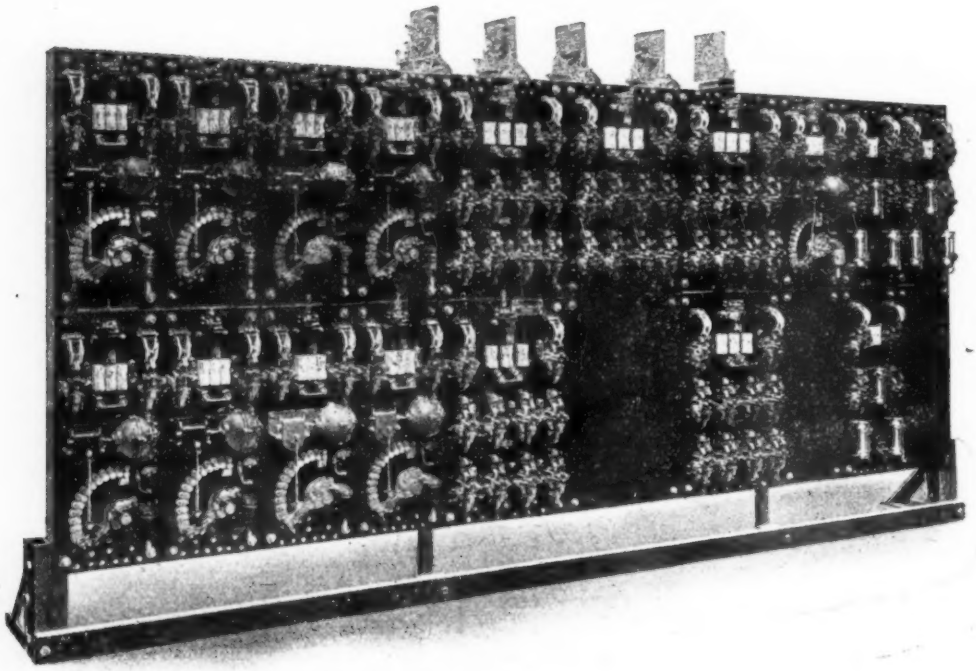

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Telephone :—BRIXTON 2075 (6 lines). *Telegrams* :—"ELAPRATUS, CLAPROAD, LONDON."

WARNING. DRAWN WIRE LAMPS.

Hampden House,
Kingsway,
London, W.C. 2.

June 27th, 1924.

Dear Trade,

You are of course somewhat familiar with the above heading which has undoubtedly influenced you and your customers to refrain from handling Non-Ring Lamps in view of the possibility of becoming involved in litigation.

This contingency was definitely removed by the unanimous decision of the Court of Appeal on June 2nd, so we invite you, who have hitherto heeded the "Warning," to join our friends who accepted our persistent assertion that there is absolute safety in dealing in FERROW LAMPS.

There is satisfaction also. Not only will you obtain GUARANTEED QUALITY and PERFECT SERVICE but we will accept your present grading and give you the benefit of our corresponding discounts—discounts which will double or even TREBLE YOUR PROFITS.

Write us NOW!

We are, Dear Trade,

At your Service,

FOR THE ANGLO-AUSTRIAN ELECTRIC LAMP WORKS LTD.

C. Newton Sales.

Sales Manager.

OFFICIAL NOTICES.

Latest time for receiving, 5 p.m. Tuesday.

WESTERN AUSTRALIAN GOVERNMENT.

Electricity Supply.

POWER STATION PLANT.

THE Government of Western Australia is prepared to receive tenders for the supply and delivery C.I.F. Fremantle, including erection, of the following:—

One 12,500-kW Turbo-Alternator, complete with Surface Condensing Plant.

Water Tube Boilers, Economiser, Fans, Chimney, &c., also Coal and Ash Plant.

The Government does not bind itself to accept the lowest or any tender.

Sealed tenders to be endorsed "Tenders for Power Station Plant," and to be lodged with the Agent-General for Western Australia, Savoy House, Strand, London, W.C.2, not later than noon on Friday, August 15th, 1924.

Copies of forms of tender and specifications will be available on and after June 23rd, 1924, on application to the Agent-General for Western Australia as above.

A charge of £1 will be made for the first two copies of each specification, additional copies being obtainable at 10s. each. These charges will not be returnable in any circumstances whatever.

Any further information can be obtained by applying to the General Manager and Engineer of the Western Australian Government Electricity Supply, Mr. William H. Taylor, at the above address, on and after June 23rd, 1924. 3524

NAVAN URBAN COUNCIL.

ABOVE Council will, at their meeting to be held on Tuesday, July 8th, 1924, consider tenders for—

(a) Storage Battery.

(b) Motor Booster.

Specification and form of tender can be had from the Consulting Engineer, Mr. J. J. Woods, Ferney House, Clynes, Co. Monaghan, on payment of one guinea, which will be refunded on receipt of *bona fide* tender. Sealed tenders, addressed to Presiding Chairman, marked A and B, must reach this office not later than 12 o'clock noon, on Tuesday, July 8th next. The lowest or any tender not necessarily accepted.

L. O. CLEIRIGH,
Acting Clerk.

Navan, Co. Meath.
June 18th, 1924. 3553

MUTFORD AND LOTHINGLAND UNION.

Installation of Electric Lighting.

THE Guardians invite tenders for installing electric light at their Workhouse and Infirmary at Oulton, near Lowestoft. Separate tenders are invited as follows:—

(a) For the Wiring installation.
(b) For the provision of a combined generating set.
(c) For the provision of a battery of accumulators.

Specifications and conditions of contract, &c., may be obtained by sending a stamped addressed foolscap envelope to me, together with a deposit of one guinea, which sum will be returned upon receipt of a *bona fide* tender. Firms applying should state the section or sections for which they intend to submit tenders.

Tenders, marked "Tender for ....." must reach me not later than first post on Monday, the 14th July.

The Guardians do not bind themselves to accept the lowest or any tender.

By Order,
F. W. OSBORNE,
Clerk to Guardians.

Crown Street Hall, Lowestoft.
June 20th, 1924. 3543

CENTRAL LONDON SCHOOL DISTRICT.

Contract for Extension of Electric Lighting Installation.

THE Managers of the Central London District School, Greenford Avenue, Hanwell, W.7, invite tenders for the extension of the electric lighting installation at the school.

Firms desiring to tender are requested to apply to the undersigned for specification and form of tender. Applications must be accompanied by a Treasury note for 10s., which will be returned to those who submit a *bona fide* tender by the time stipulated.

Sealed tenders are to be delivered at the offices of the Central London District School, addressed to the undersigned not later than 11 a.m. on Saturday, July 26th, 1924.

The Managers do not bind themselves to accept the lowest or any tender.

The firm whose tender is accepted will be required to enter into a contract for the due performance of the work.

By Order, GEORGE P. MORRELL,
Clerk to the Managers. 3577

OFFICIAL NOTICES.—*Continued.*

LEYTON URBAN DISTRICT COUNCIL.

To Electrical Wiring Contractors.

THE Council invite tenders for the Electrical Wiring of 6 Schools on the Henley system. The work is to be carried out with the engagement of unemployed labour obtained through the Local Employment Exchange in accordance with the conditions laid down by the Unemployment Grants Committee.

Specification, conditions and form of tender may be obtained on written application to Mr. John H. Jacques, Licentiate R.I.B.A., 61, West Ham Lane, Stratford, E.15, not later than Friday, July 4th, 1924, which application must be accompanied by a deposit of £1, to be returned to those who send a *bona fide* tender in the manner and at the time stipulated.

Sealed tenders (in specially endorsed envelope supplied with the form) must be delivered to me at the Town Hall, Leyton, E.10, on or before Friday, July 18th, 1924, at 12 o'clock noon. The Council does not bind itself to accept the lowest or any tender.

By Order,
JNO. ATKINSON,
Clerk.

Town Hall, Leyton, E.10.
June, 1924. 3602

ELECTRIC LIFTS.

FOR the New Legislative Buildings, Delhi. Six passenger lifts, one goods lift and two sets of two service lifts.

For the Government House, Delhi. Five passenger lifts, three goods lifts and seven service lifts.

Tenders are invited for the manufacture, delivery in India, erection and testing on site, with endurance test of one week, of the above lifts.

Tenders will be considered in India on 24/8/24.

Firms not already submitting tenders through their Indian agents may inspect copies of the forms of tender and drawings at the India Store Depôt, London, by application to:—

THE DIRECTOR-GENERAL OF STORES,
Branch No. 36,
Belvedere Road, Lambeth, S.E.1.

3576

WIRING.

THE Commissioner of His Majesty's Works, &c., are prepared to receive tenders before 11 a.m. on Tuesday, July 15th, 1924, for electric wiring in steel conduit at Somerset House, W.C. Specification, Form of Contract, Bills of Quantities and Forms of Tender, &c., may be obtained from the Contracts Branch, H.M. Office of Works, King Charles Street, London, S.W.1, on payment of one guinea. (Cheques payable to The Secretary, H.M. Office of Works). The sums so paid will be returned to those persons who send in tenders in conformity with the conditions. 3598

NOTICES RELATING TO PATENTS.

Advertisements are inserted under this heading at 14s. per inch.

PATENTS AND DESIGNS ACTS, 1907 & 1919.

THE Proprietor of British Patents Nos. 148,380, 174,061 and 174,312, is prepared to sell the patents to British Manufacturers. The inventions relate generally to electric high-frequency signalling systems and particularly to carrier-wave systems of wireless telegraphy and telephony.

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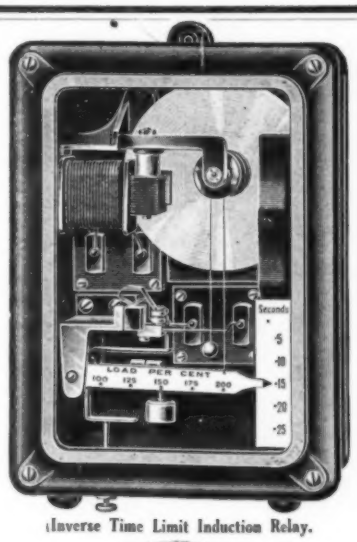

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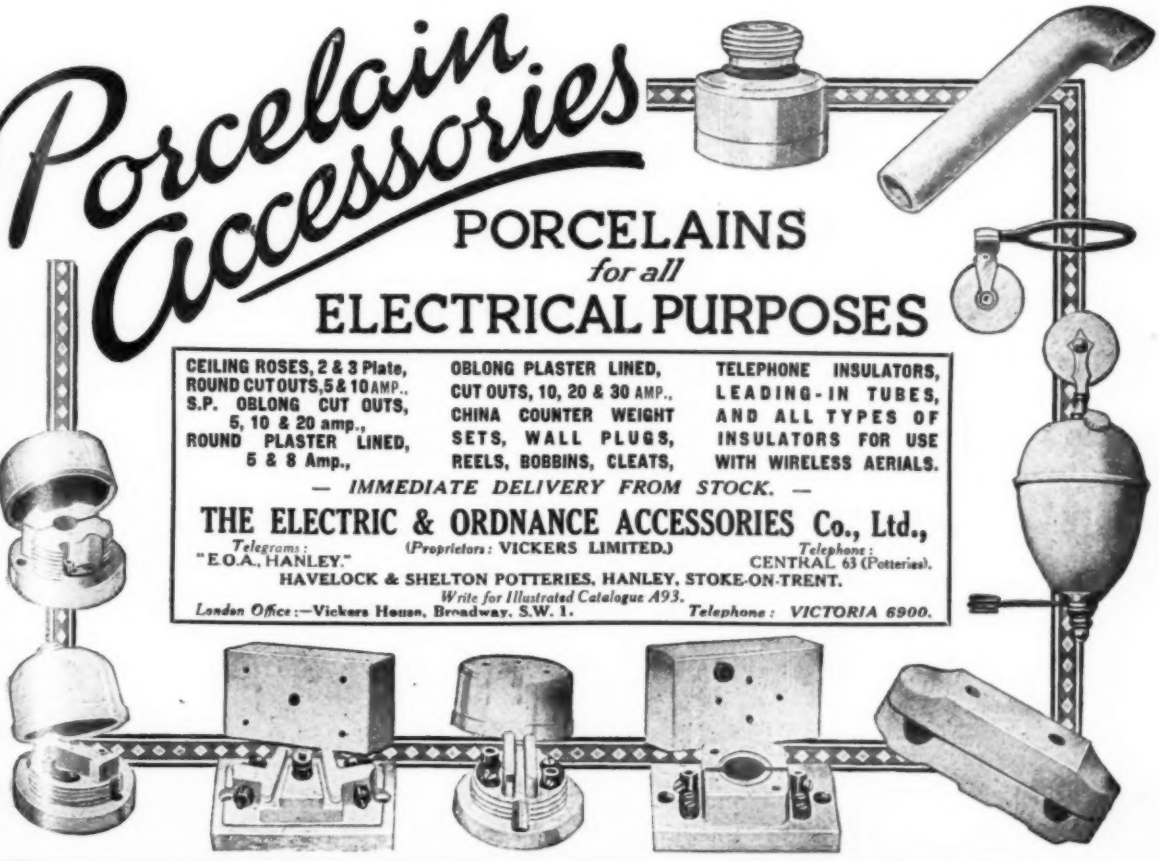
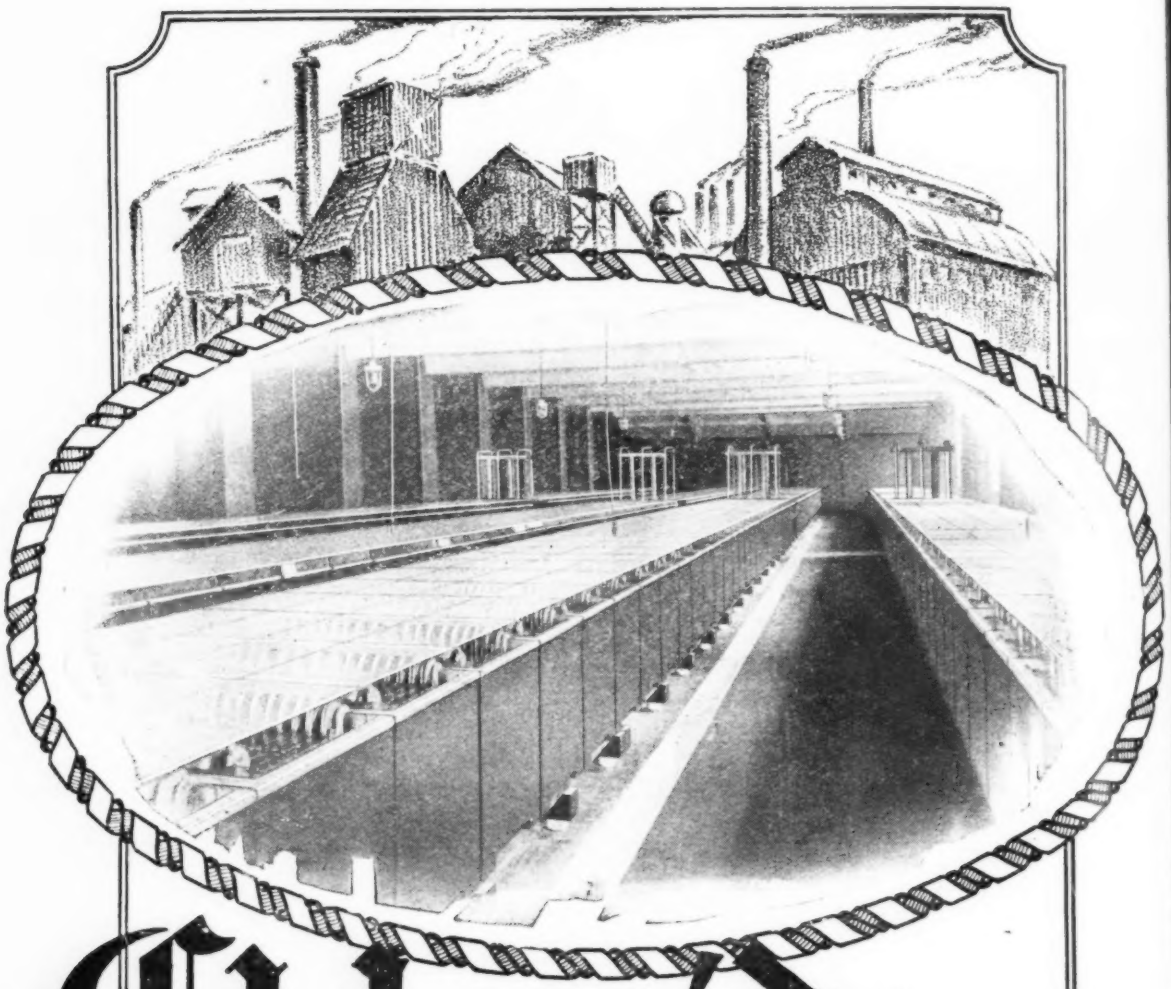


EXHIBITORS IN THE PALACE OF ENGINEERING, BRITISH EMPIRE EXHIBITION.



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The Polar Cub Fan has a first-class fully guaranteed motor running on bronze bearings, with a reservoir oiling system, smooth-running and quiet. The drawn steel shell is finished in black rubber enamel. Blades and guard are of solid brass, highly polished and lacquered. Fan tilts to any angle, or hooks on the wall. Universally wound A.C. or D.C. Draws one unit per 40 hours running. Voltages 100/110, 200/220, 230/250. Size of fan—6 inches. Fully guaranteed by the **Makers**.

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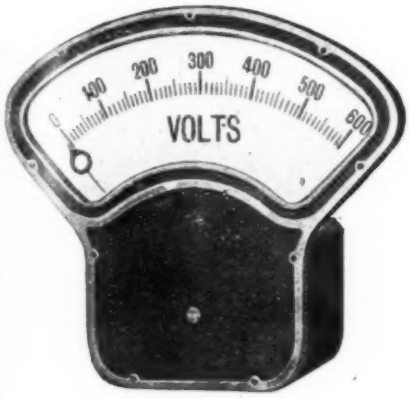

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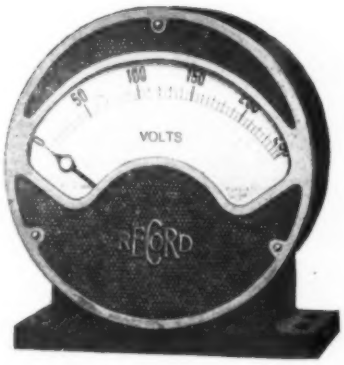

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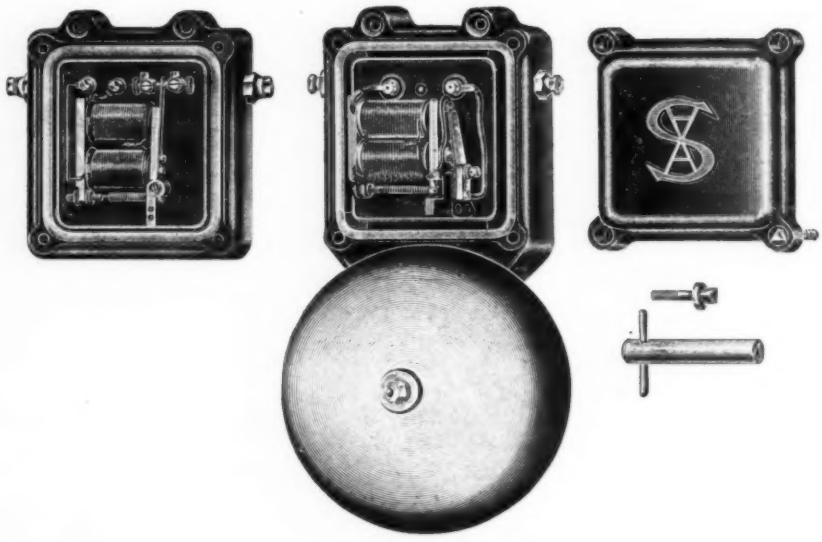

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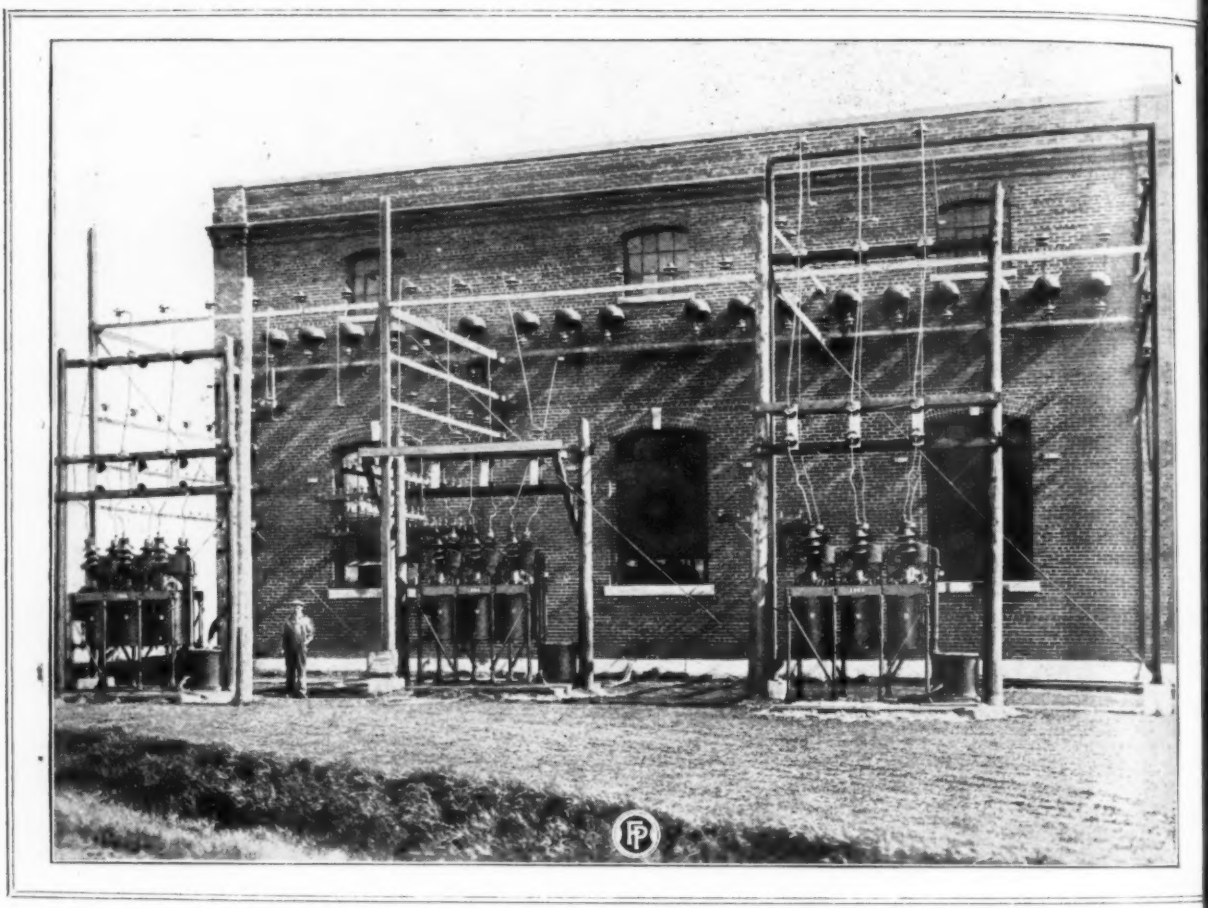

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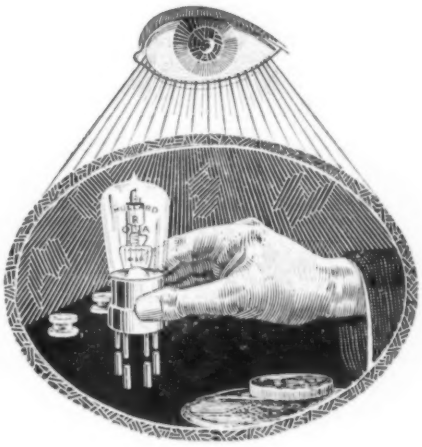

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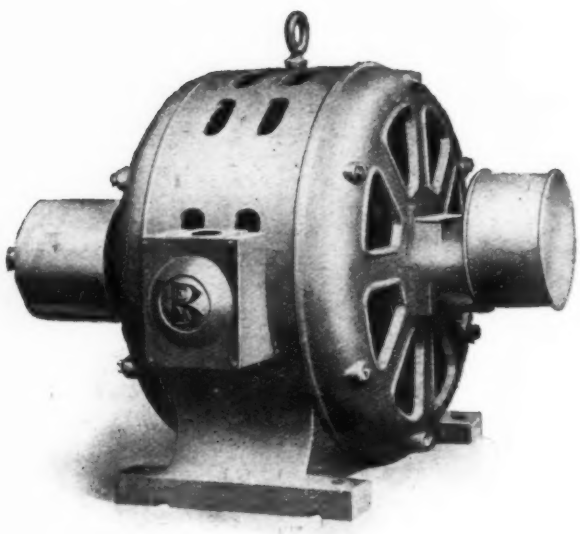

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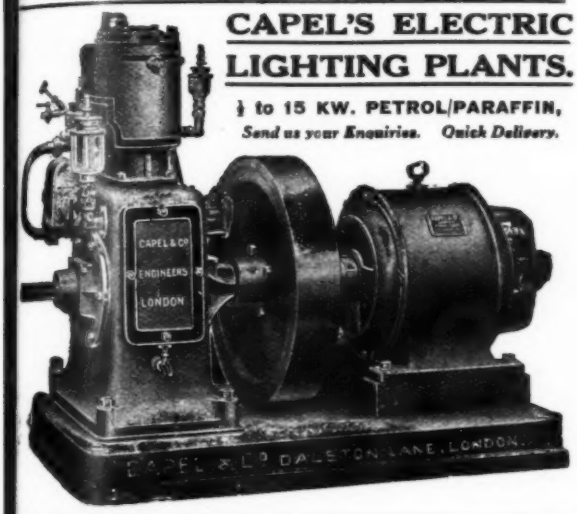

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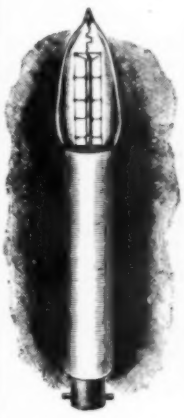

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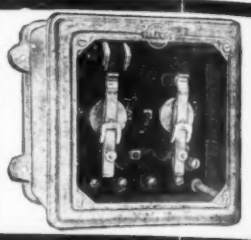

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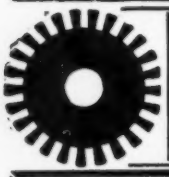

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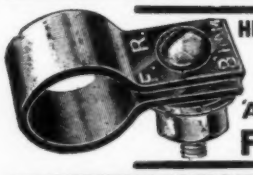

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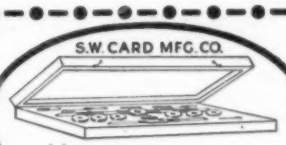

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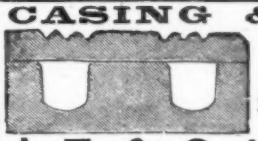

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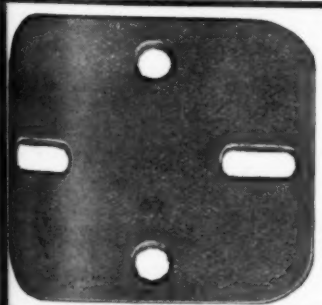

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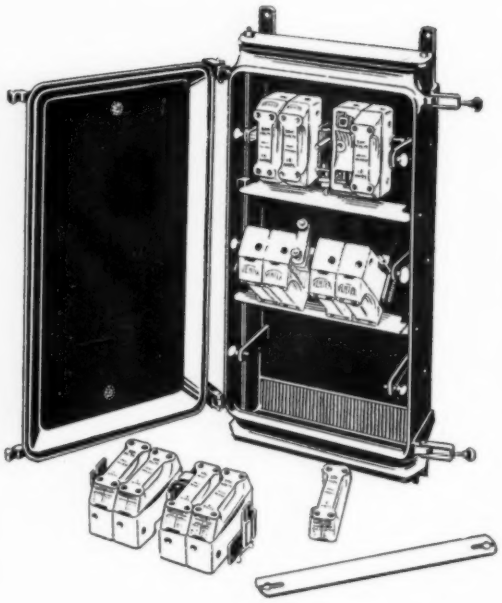

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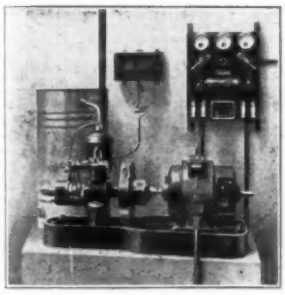

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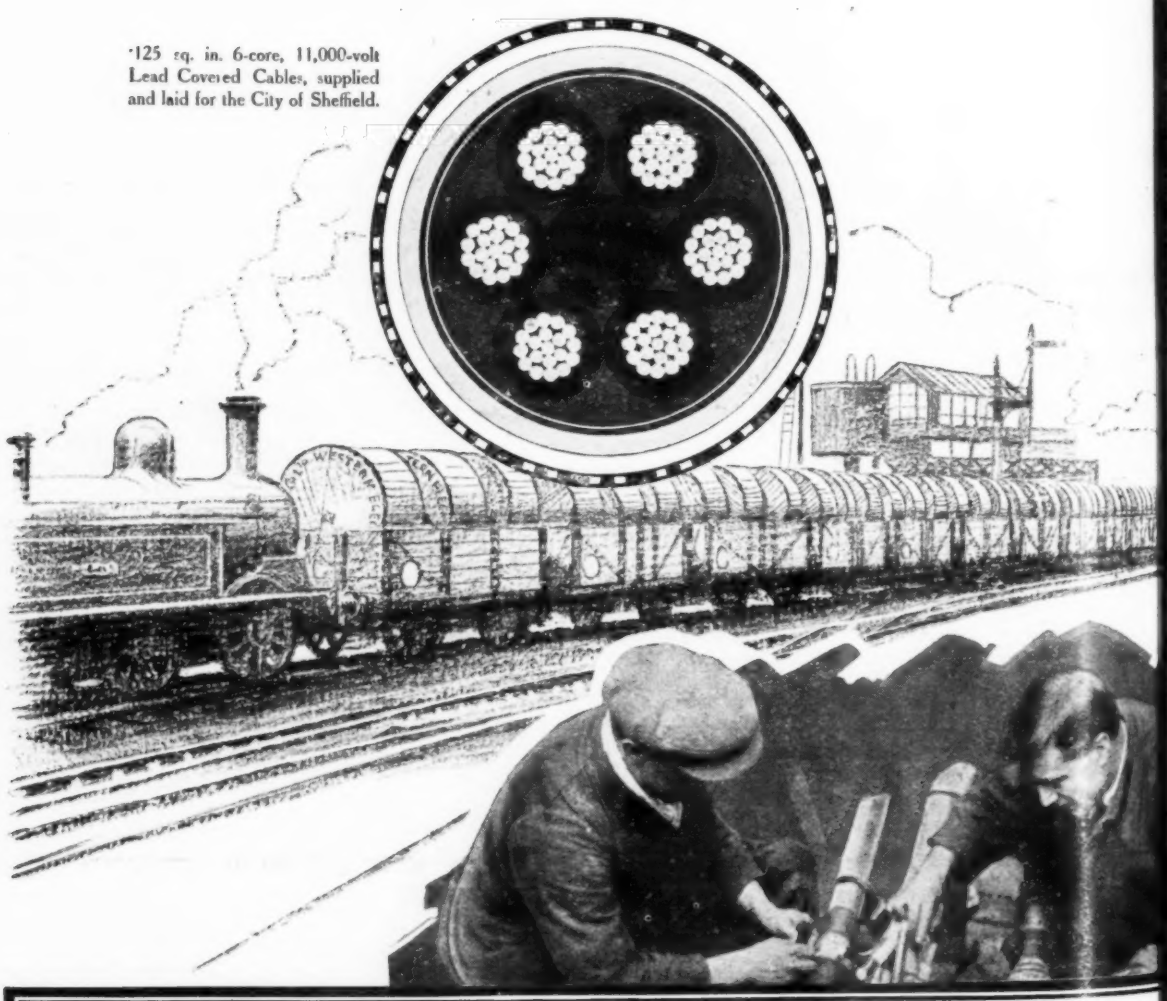

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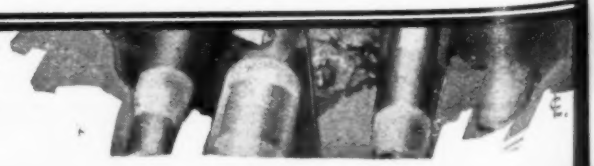

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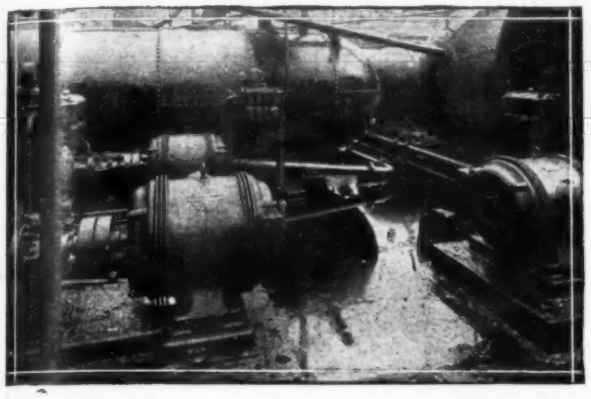

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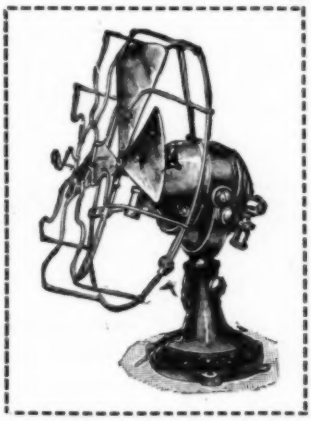

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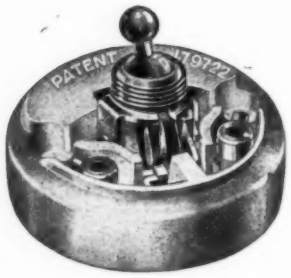

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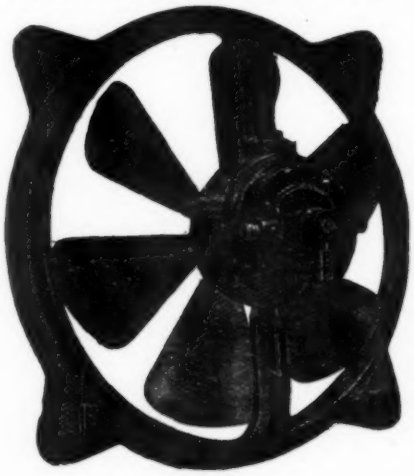

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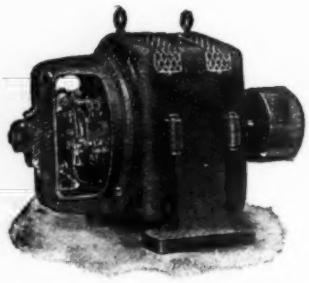

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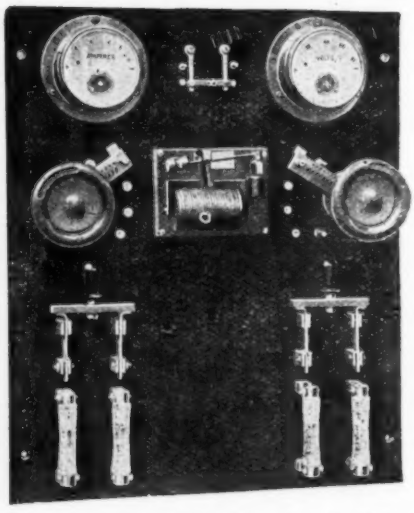

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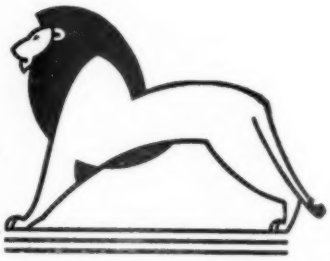

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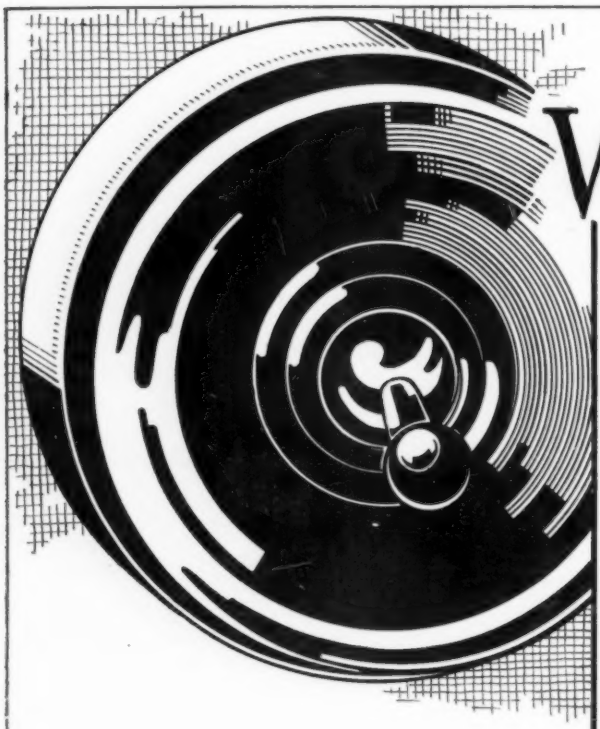

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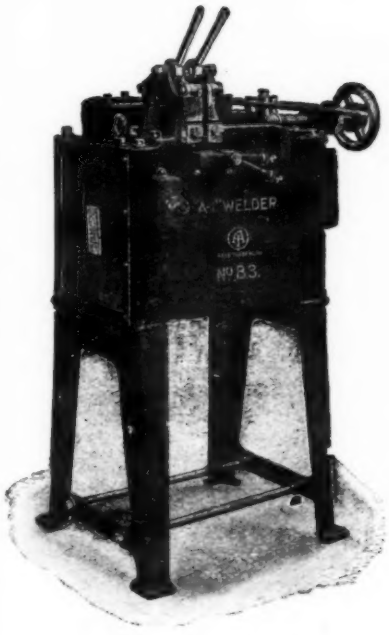

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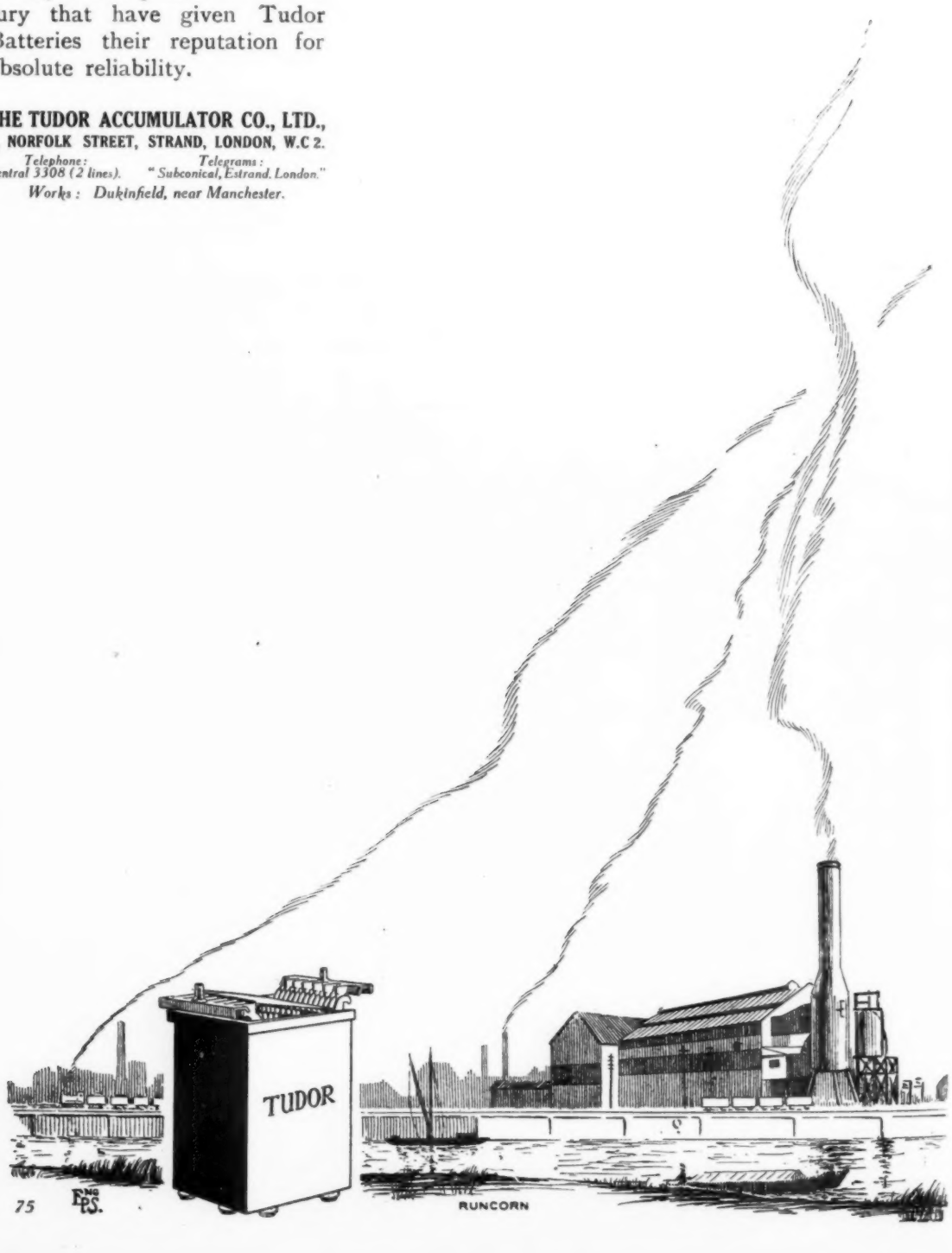

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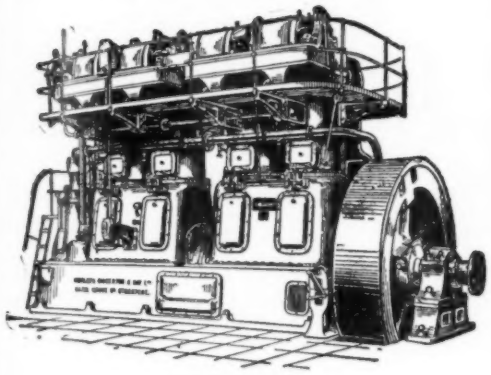

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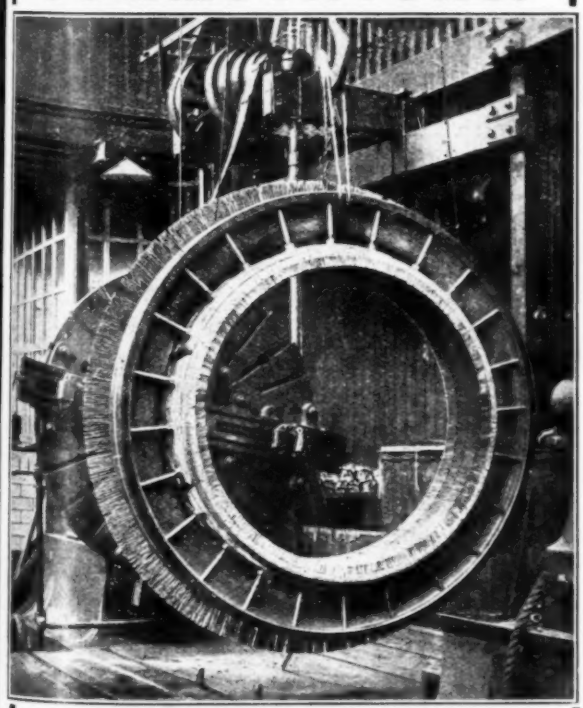

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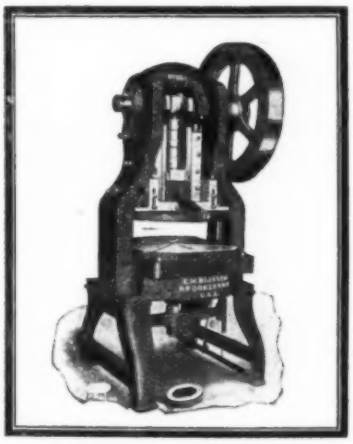

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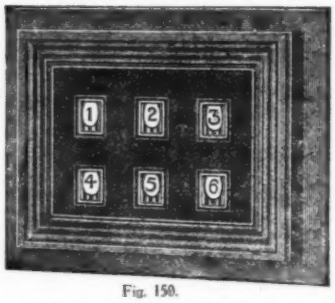

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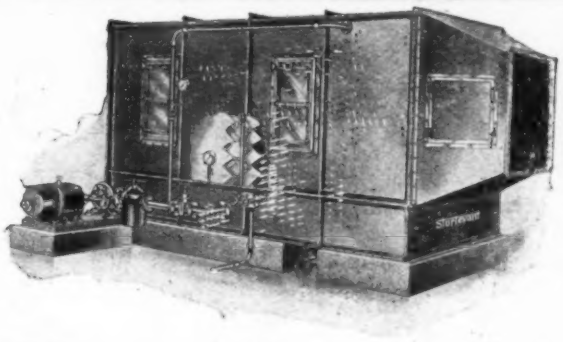

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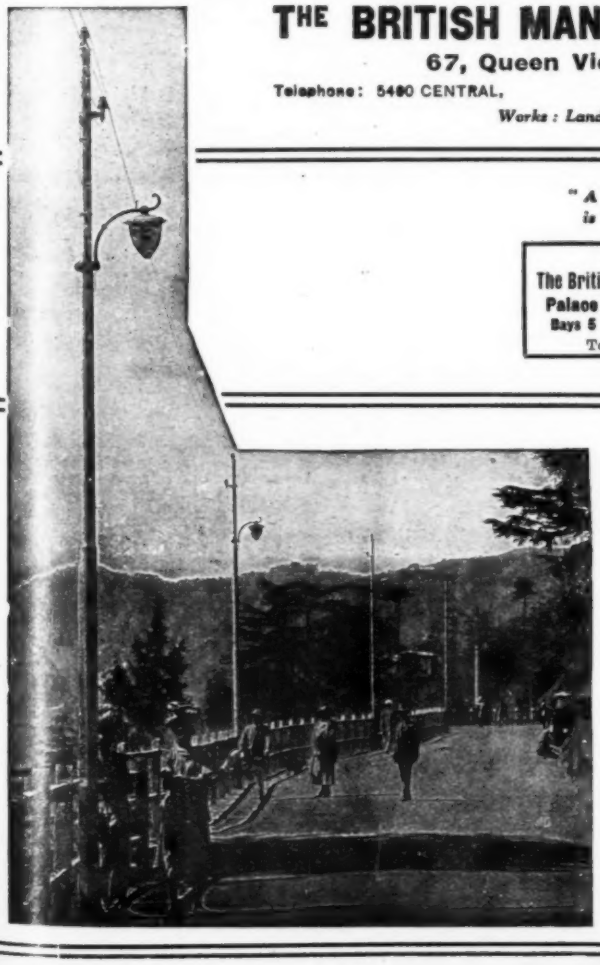

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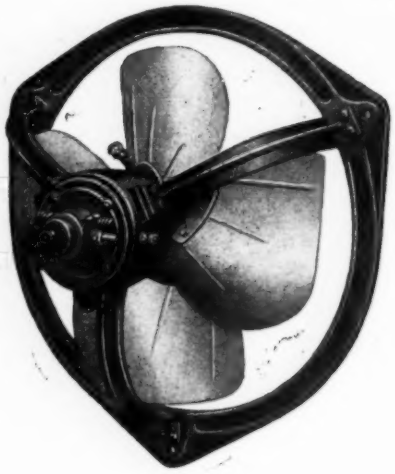

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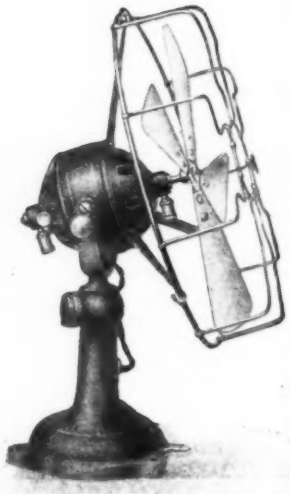

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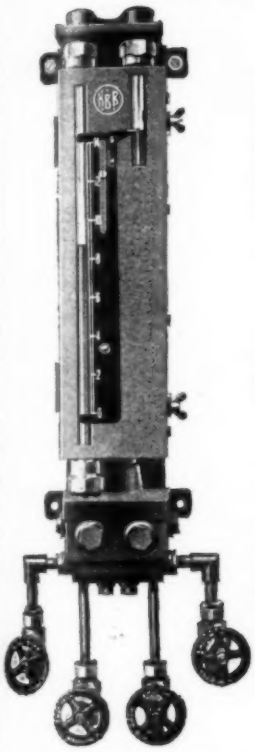

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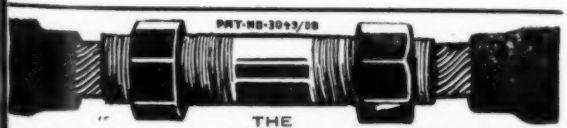

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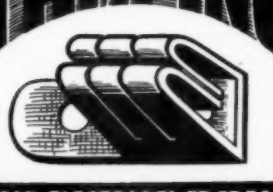

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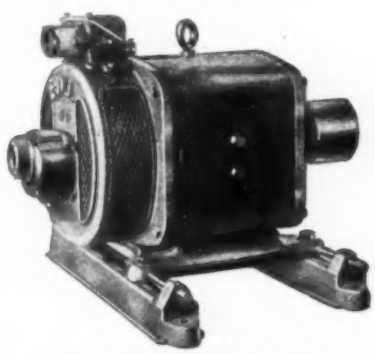

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BIRMINGHAM: 53, Summer Row, Birmingham
Telephone: Central 2442. Telegraphic Address: "Frequency," Birmingham.
LEEDS: Imperial Buildings, 28, Bond Street, Leeds
Telephone No.: 21342.
MANCHESTER: "Craven Bank," Osborne Rd., Levenshulme.
Telephone: Central 765. Telegraphic Address: "Superlux" Manchester.
BRISTOL: 6, Bristol Bridge, Bristol
Telephone No.: 4767. Telegraphic Address: "Eclipse" Bristol.

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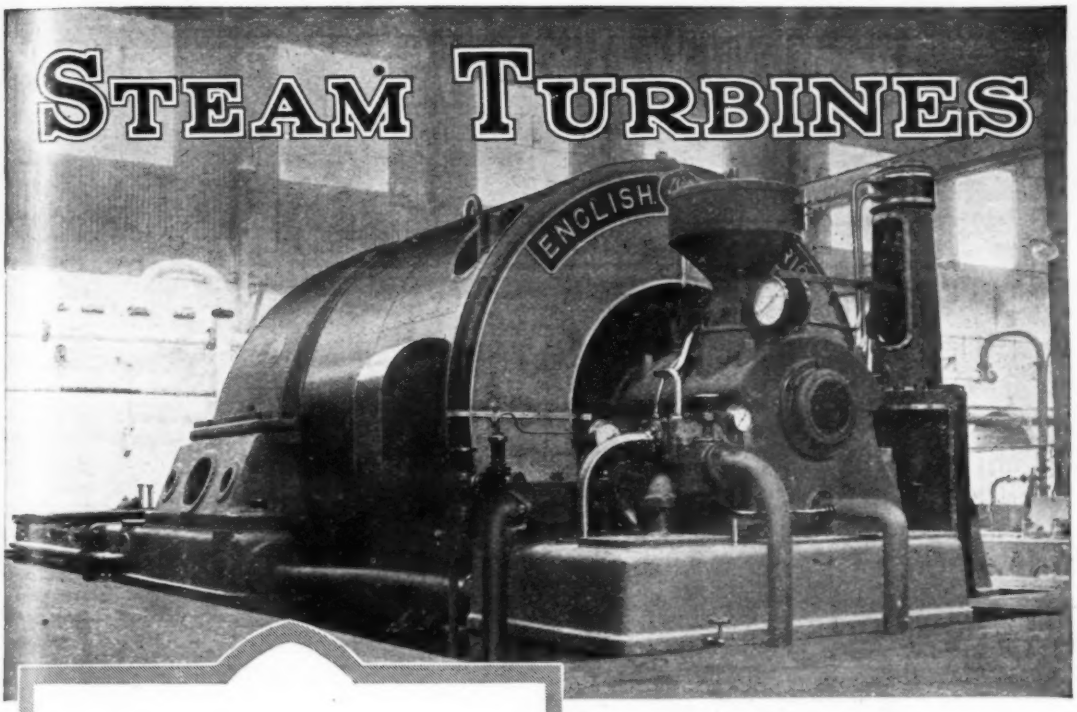
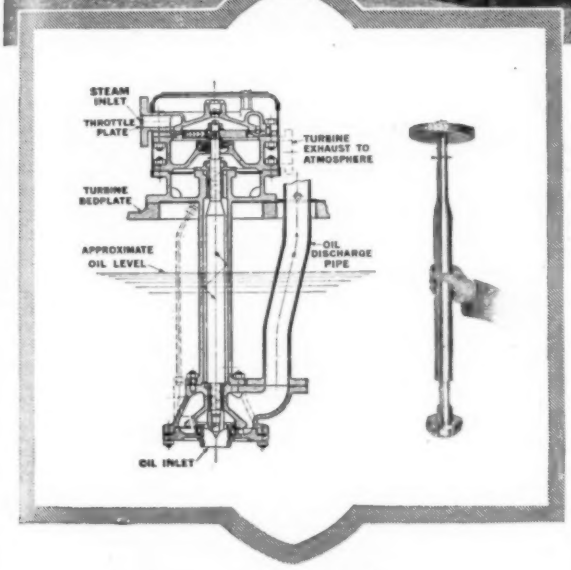
MANCHESTER:
25/27 Faulkner Street.

Telephone - - CITY 435 and 7689

STEAM TURBINES





TURBINE DRIVEN AUXILIARY OIL PUMP.

These Pumps are being fitted in place of reciprocating direct driven steam pumps and present the following features :—

Control

Automatic or by hand.

Cleanliness.

(1) No escape of steam or oil.
(2) No leakage of steam into oil.

Reliability.

(1) Only one moving part.
(2) Turbine Rotor and Blading in one piece.
(3) Maximum speed limited by Throttle Plate.

Cost of Upkeep.

(1) No wearing parts.
(2) All parts easily accessible.

The illustration above shows one of several 8,000 KW., 1,500 R.P.M. Turbines for 25 cycle supply ; and inset, the Rotor and sectional drawing of the Auxiliary Oil Pump.

TURBINE ADVT. SERIES. No. 2.

The ENGLISH ELECTRIC Company, Limited,

WORKS: BRADFORD, COVENTRY, PRESTON, RUGBY & STAFFORD.

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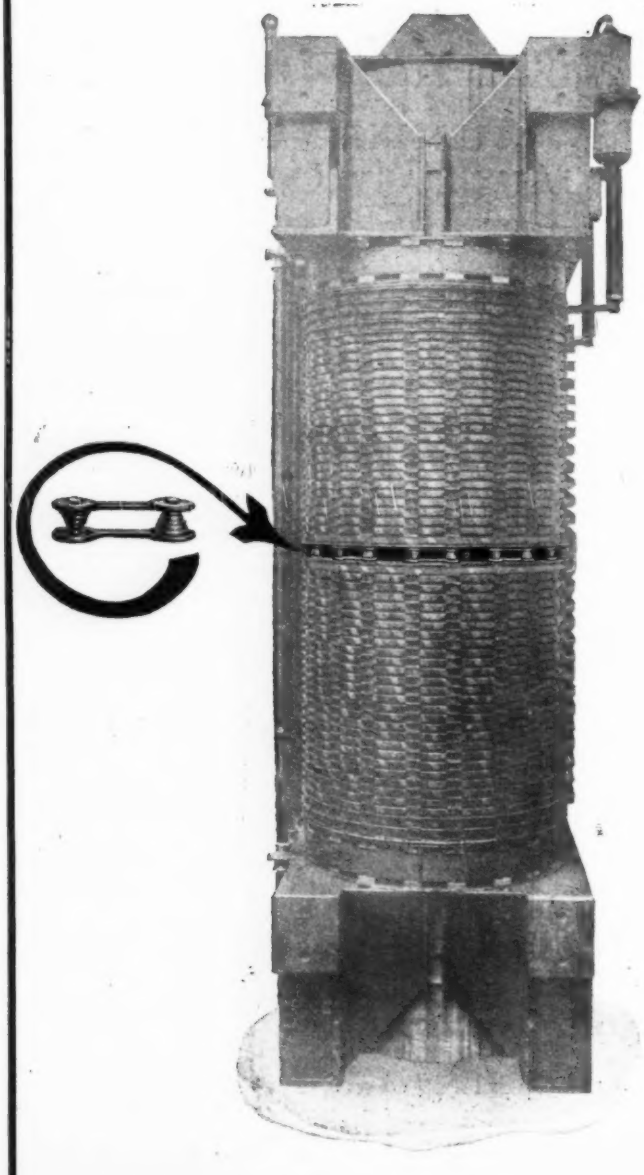
PATENT

SPRING COIL CLAMPING DEVICE FOR TRANSFORMERS



1.—Prevents uneven distribution of compression during assembly.

2.—Needs no inspection or adjustment.

3.—Allows expansion with change of temperature.

4.—Takes up coil shrinkage.

5.—Is not compressed on short circuit.

6.—Does not disturb the magnetic balance when taking up shrinkage in the windings.

7.—Is sectionalised, and evenly distributed.

8.—Is foolproof.

9.—Is the only practicable method where adjustment is necessary on the low tension.

FERRANTI, LTD.,
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Your enquiries, please

WE can quote special prices against large requirements of all classes and types of Insulating Varnishes and Compositions, Machine Finishes, etc. It will pay you to send us your enquiries.

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to all who are in any way connected with the electrical industry in all its branches. Our advice is that they should

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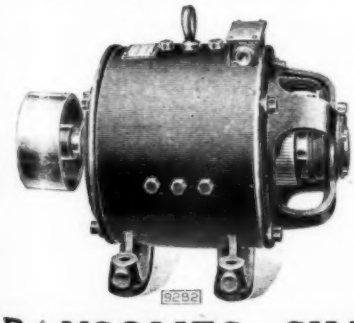

The outstanding features of "RANSOME" continuous current Dynamos and Motors include sturdy construction, up-to-date design and good finish. They comply fully with British Standard Specification No. 168/1923.

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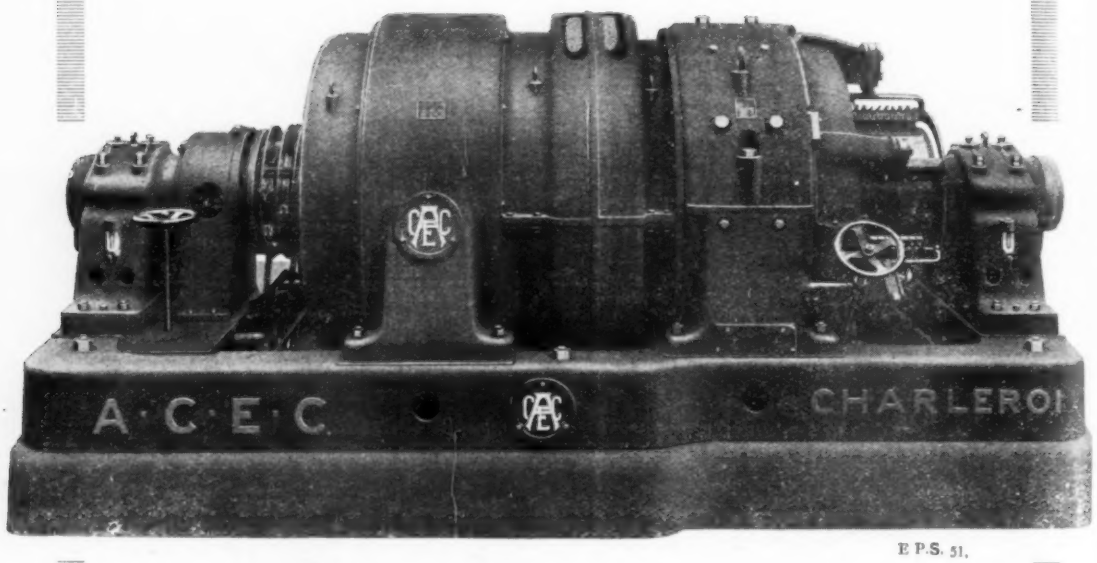
A·C·E·C

LA COUR MOTOR CONVERTERS.



E P.S. 51.

No. 1.—General Features.

The above illustration shows a 1,000-KW. A.C.E.C. La Cour Motor Converter of the very latest type embodying many important features which place this machine in a class by itself. It is of the self-synchronising (A.C.E.C. British patents 7135/1912, 5481/1913 and 15875/1913) enclosed ventilated, two-bearing type; the armature and rotor are mounted on separate shafts, and the stator end windings are supported by heavy insulating blocks securely bolted to the stator frame as in the case of a turbo-alternator. It is provided with barring gear, special earthing slip ring, speed-limiting device, and self-aligning bearings having automatic oil and air circulation.

Following advertisements will illustrate some of the more important features of this machine.

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ATELIERS DE CONSTRUCTIONS ELECTRIQUES DE CHARLEROI

LONDON OFFICE

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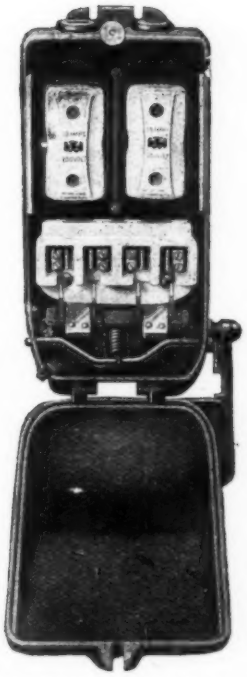
TELEGRAMS: EDEMPAIN·SOWEST·LONDON· Codes: A·B·C·5ed·ENGINEERING·LIEBERS



RUPTOR A. D.P. Ironclad Switch & Fuse,
15 Amps., 250 Volts—Quick Make and Break.

Gambling with the future

Each component part of your Service provides a gamble as to the future life of your installation unless you are certain of the quality of the material you select. It is a sheer gamble to put in cheap Ironclad Switch and Fuse Gear when little is known of its performance in Service. The "RUPTOR 1" D.P. Ironclad Switch, and the "RUPTOR A" D.P. Ironclad Switch and Fuse comply with the Dielectric, Mechanical Endurance, Breaking Capacity, and Temperature Rise Tests of B.E.S.A. Specification No. 124/1923. Full particulars are given in Catalogue W.L.5. If you have not received your copy please write for it.

HENLEY

RUPTOR A

Regd.

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Manufacturers of Ironclad Gear since 1904

W. T. HENLEY'S TELEGRAPH WORKS CO., LTD., BLOMFIELD STREET, LONDON, E.C.2

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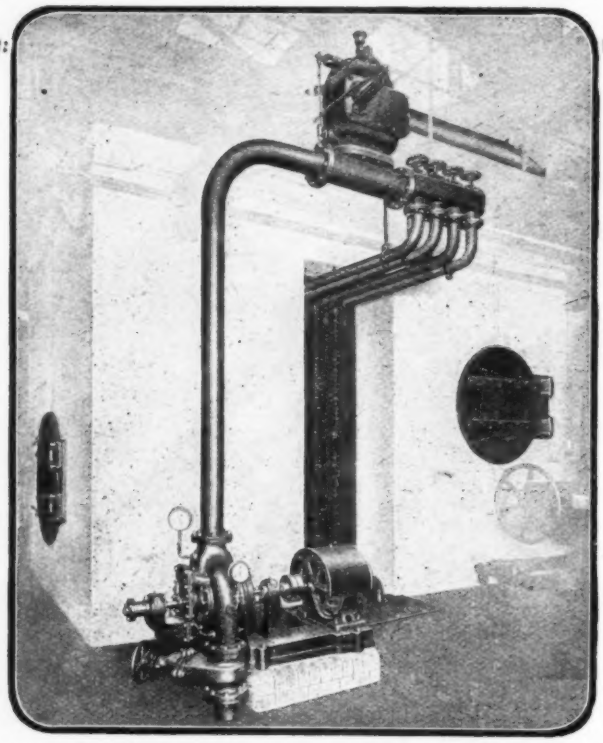

AN 8,000-KW. TURBO-ALTERNATOR INSTALLATION.

Parsons Alternator Air Cooler in position, showing arrangement of water service and illustrating the compact arrangement inside the Alternator Foundation Block.

PARSONS

Closed Circuit System of

ALTERNATOR VENTILATION

Clean.
Cool.
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Parsons Air Coolers for over 700,000 K.V.A. of Alternators in Commission or under construction since 1918.

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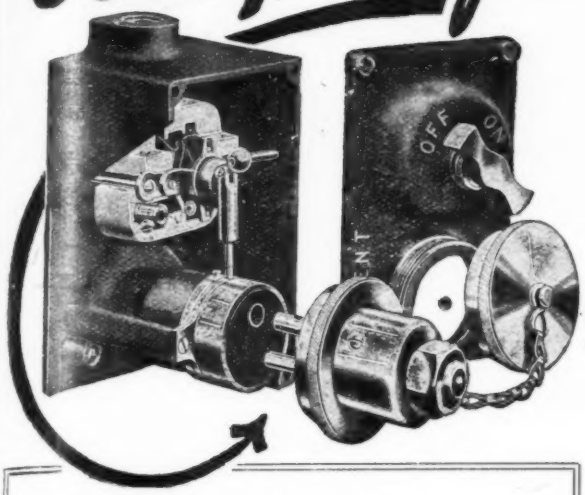
Absolutely Fool-proof!



IMPOSSIBLE TO INSERT OR WITHDRAW PLUG ON A LIVE CIRCUIT.

The above illustration shows the shooting bar action, operated by a turn of the handle that controls the Switch Movement.

"Walsall"

Patent Watertight Interlocking Switch Plug

NO RUBBER OR PERISHABLE MATERIAL USED.

Walls and cover of box so accurately machined as to be absolutely watertight.

QUICK MAKE and QUICK BREAK SWITCHES.

Plug and Socket of unbreakable non-hygroscopic insulating material with heavy protected terminals and substantial earthing pin.

Fitted with "Walsall" Grid attachment providing easy back wiring, efficient earthing and ample space for spare cables.

93% OF ALL ORDERS RECEIVED ARE DESPATCHED THE SAME DAY

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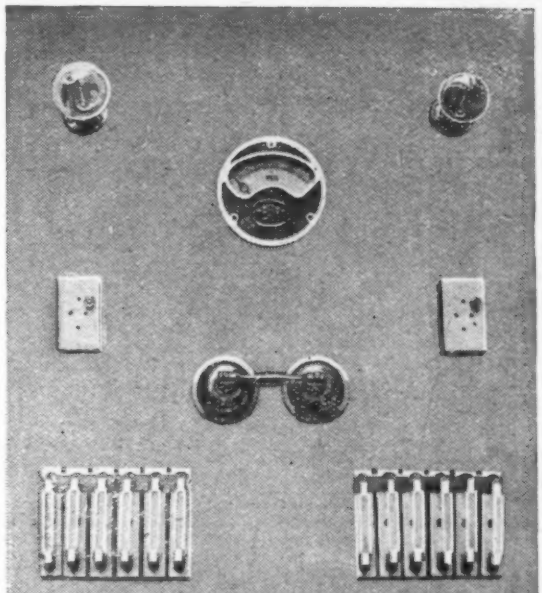
M.G.P.



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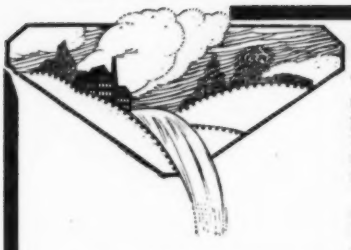

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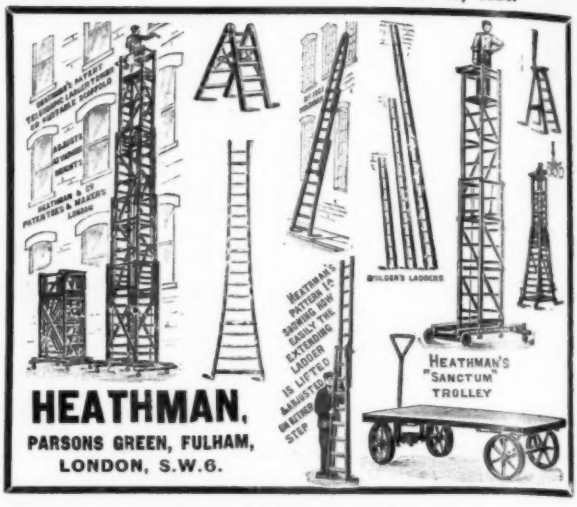
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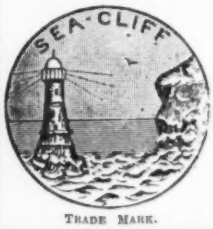

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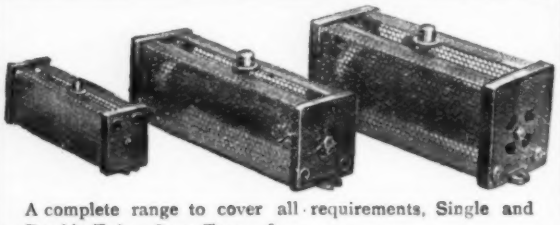

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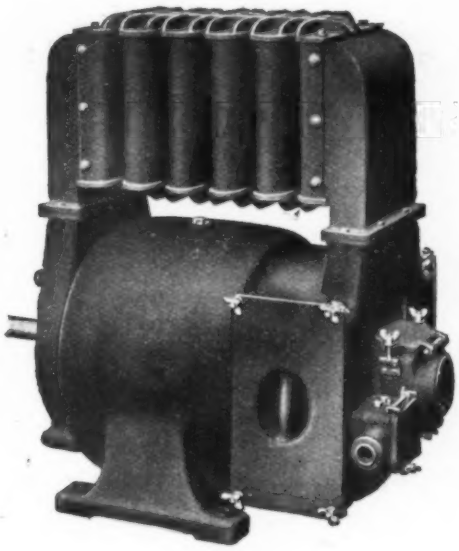

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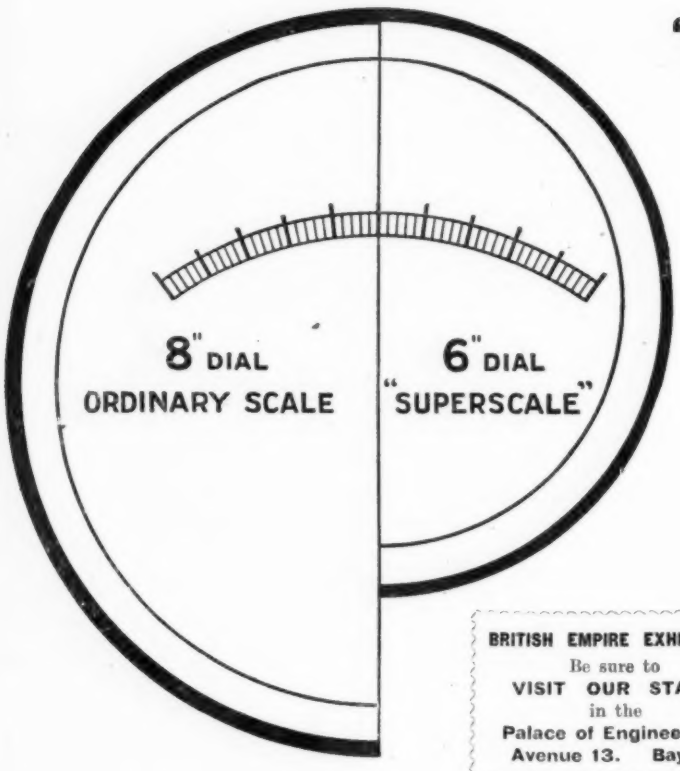

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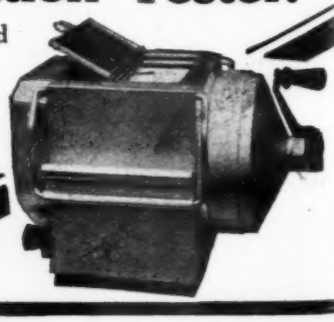

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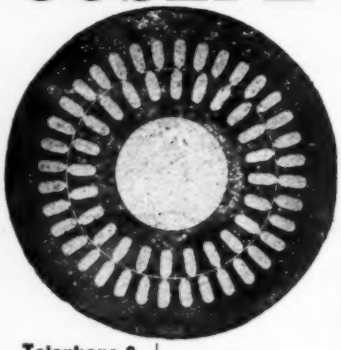

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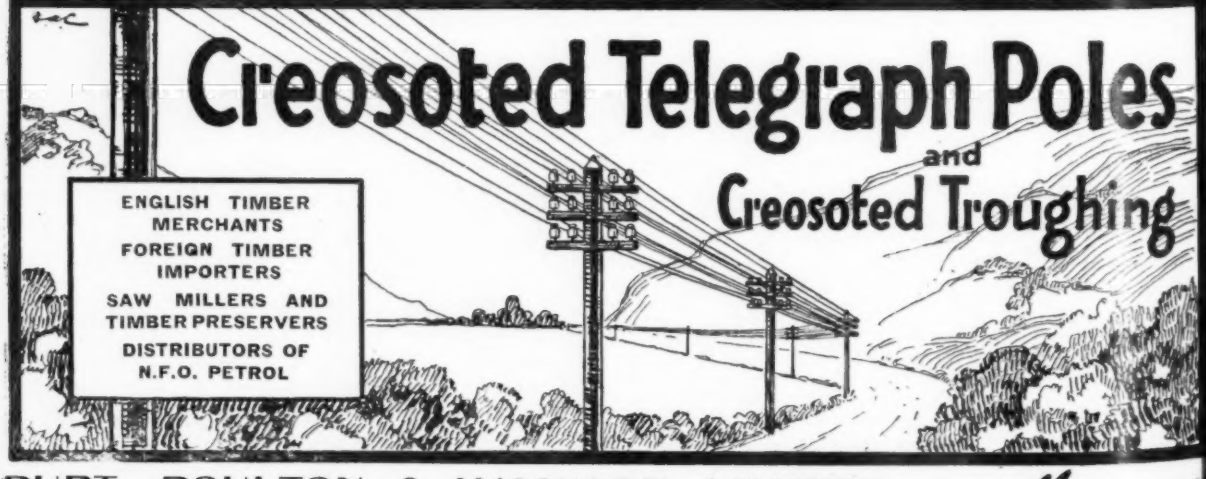

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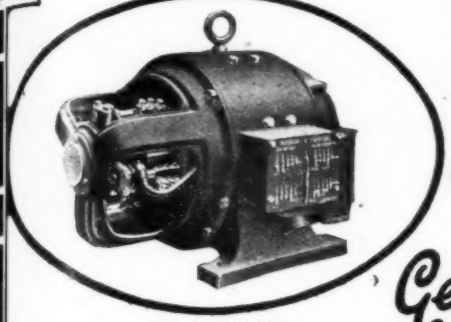

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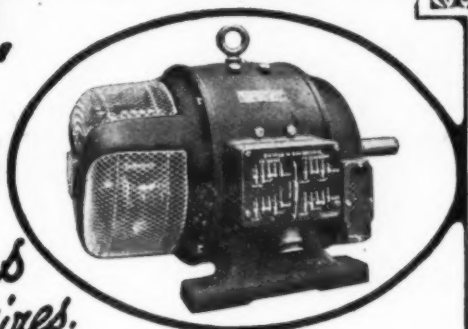

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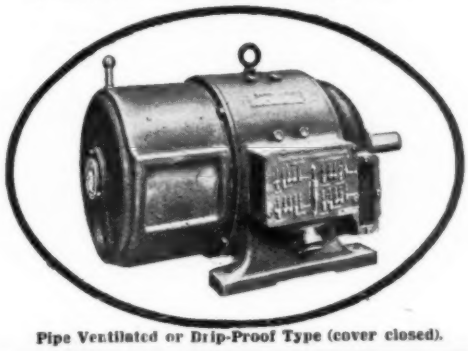

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"The primary object of this book is to provide a 'practical aid' to those who have under their care the running, maintenance and repair of three-phase induction motors, and have not either the training or experience necessary to deal with the many practical problems that arise from time to time."

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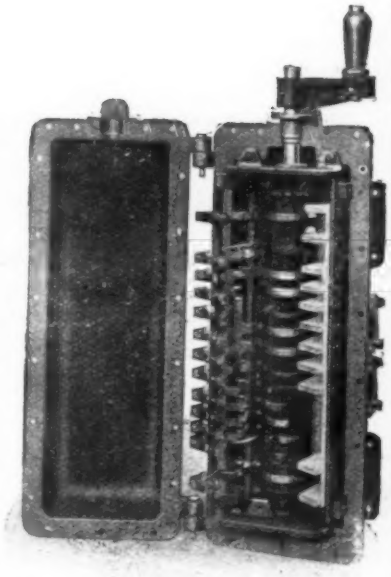

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ALDEBURGH.—Roman Catholic church; Rev. C. M. Davidson, resident priest.

ASHTON-UNDER-LYNE.—Electricity sub-station, Mossley Road, for the T.C.; E. Garside, Town Hall Chambers.

AYRSHIRE.—Secondary school at Cumnock; clerk, Education Authority, Ayr. Alterations to Prestwich Parish Church (£7,000); the minister.

BARNES (SURREY).—Secondary school (£20,000); secretary, Surrey Education Committee, Penrhyn Road, Kingston-on-Thames.

BARNET.—Housing scheme, for the U.D.C.; surveyor.

BELFAST.—Housing scheme (500), for Corporation; city engineer.

BLACKBURN.—Heald and reed works, Albion Road, for H. Oates & Sons.

BLACKPOOL.—Housing scheme (48), Devonshire Road, for T.C.; borough surveyor.

BOLTON.—Church, Smethurst Lane, for St. Bede's, Morris Green; Rev. J. W. Willis, vicar.

BOURNE (LINCS.).—Housing scheme, for the U.D.C.; surveyor.

CAMBRIDGE.—Operating theatres, &c., for the governors of Addenbrooke's Hospital; W. H. Head, secretary-superintendent.

CLACKMANNAN.—Additions to public school; Thomas Frame & Son, architects, 43, Mill Street, Alloa.

COLCHESTER.—Extensions to education offices, for the T.C.; Duncan W. Clark, architect, St. Runwalds, 3, West Stockwell Street.

COULSDON AND PURLEY.—Housing scheme (54), for the U.D.C.; R. Chart, surveyor, Purley.

CREDITON.—Alterations to Queen Elizabeth's Grammar School, for Devon E.C.; Education Architect, 1, Blackall Road, Exeter.

CREWE.—Church of England, in South Ward (£12,000); vicar of Crewe.

CUCKFIELD (SUSSEX).—Infirmary (£12,964), for the Board of Guardians; the clerk.

DUMFRIES.—Police stations, for County Council; Mr. John Robson, county clerk, Dumfries.

EARLESTOWN (LANCS.).—Church of Christ; trustees.

EVESHAM.—School; H. E. Dicks, architect.

EYTHORNE (DOVER).—Business premises, Chaple Hill, for the River and District Co-operative Society; L. S. Ekins, architect.

GARFORTH.—Housing scheme, for U.D.C.; C. S. Nelson and G. Birkinshaw, architects, Sun Buildings, 15, Park Row, Leeds.

GLASGOW.—Hospital at Govan; Keppie & Henderson, architects. Reinstatement of engine works (after fire), for James Binnie & Sons, Ltd.

GREAT WYRLEY (WALSALL).—Church hall (£5,000), for the Wesleyan trustees; the secretary.

HASLINGDEN.—Maternity home; clerk to Board of Guardians.

HAZEL GROVE.—Electricity sub-station, for Hazel Grove and Bramhall U.D.C.; F. Pidgeon, clerk to the Council.

HEYWOOD.—Extension of offices, Buckley Street, for Mutual Mills, Ltd. Engine house and extension of boiler house, Chumble Mill, for James Kenyon & Son, Ltd.

HORWICH (NEAR BOLTON).—Housing scheme (30), for U.D.C.; surveyor to U.D.C.

HUDDERSFIELD.—Renovations, &c., at Shelley Council School and at Shepley Council School, for West Riding Education Committee; William Heeley, divisional clerk, 4, Macaulay Street.

HULL.—Works, for the London & North-Eastern Railway.

IPSWICH.—Baptist church on Corporation housing estate; trustees, Turret Green Baptist Church.

KETTERING.—Boot factory, Avondale Road, for Tom Hales & Sons (£20,000).

KINCARDINESHIRE.—Alterations to Parish Church of Fettercairn; G. P. K. Young & Son, 42, Tay Street, Perth.

KIRRIEMUIR.—Convalescent hospital; ; Mr. Charles D. Soutar, architect, Dundee.

LEEDS.—Extension of warehouse, West Street; F. Mitchell & Sons, architects, 9, Upper Fountaine Street.

LEIGH-ON-SEA.—Wesleyan church, Highlands estate; trustees.

LIVERPOOL.—School, Edge Lane Drive; C. F. Mott, Director of Education, 14, Sir Thomas Street.

LONDON (W.C.2).—Freemasons' Hall, Great Queen Street; general secretary.

(LEYTONSTONE, E.).—Extensions to operating room, Whipps Cross Hospital, for the Board of Guardians; F. J. Sturdy, architect, 113, Moorgate, E.C.

LYMM (CHESHIRE).—Housing scheme (20), for the U.D.C.; H. Mort, surveyor.

MAIDSTONE.—Grammar school, for Kent E.C.; Director of Education, Sessions House,

MERTHYR TYDFIL.—Housing scheme, Gellifaelog (60), for the T.C.; housing architect.

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NEWMARKET (SUFFOLK).—Houses, The Rows, for the U.D.C.; W. H. Eley, surveyor, Godolphin House.

PADIHAM.—Weaving mill, for Church Street Manufacturing Co.

PERTH.—Restoration of St. John the Baptist Church; the minister.

PRESTWICK (AYR).—Alterations, &c., Parish Church (£7,000); the trustees. Houses (£4,000), Midton Road, for George Headrum, builder.

REDCAR.—Schools, for North Riding E.C.; the clerk, North Riding.

REDDITCH.—Nurses' home, for the Headless Cross, Webheath and District Nursing Association; V. Woodfield, chairman.

RENFREW.—Offices, for Parish Council (£5,700); the clerk.

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ROMFORD.—Wiring Institution for electric light, for the Board of Guardians; architect to the Board.

SEDGEFIELD.—Workmen's club premises, Trimdon Colliery, for Trimdon Colliery and Deaf Hill Workmen's Club Committee.

SOUTH CROSLAND.—Adaptation of Conservative Club for Council Offices, for U.D.C.; Hy. Boys, surveyor to U.D.C.

STAFFORD.—New premises, Market Square, for Barclay's Bank, Ltd. Sewage disposal works (£25,000); borough surveyor.

STAMFORD (LINCS.).—Additions to infirmary (£11,000), for the Management Committee; Traylen & Lenten, architects.

STIRLING.—Premises, for F. W. Woolworth & Co., Ltd.; the secretary, Victory House, Kingsway, London.

SURBITON.—Adaptation of Allbury House as school (£4,500); W. W. Finny, secretary, Surrey Education Committee, Penrhyn Road, Kingston-on-Thames.

SWANSEA.—School for 1,300 scholars (£53,350); secretary to the Education Committee.

TAUNTON.—Alterations, Castle Hotel, for Harrison's Hotels, Ltd.

THIRSK.—Kinema; Thos. Stokes, architect.

THURCROFT.—Schools, for West Riding E.C.; the clerk, County Hall, Wakefield.

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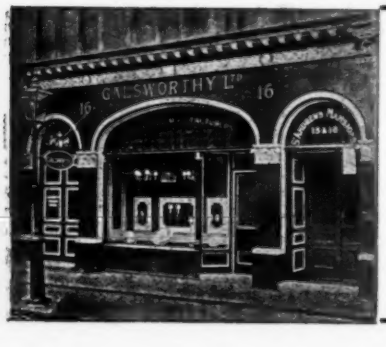

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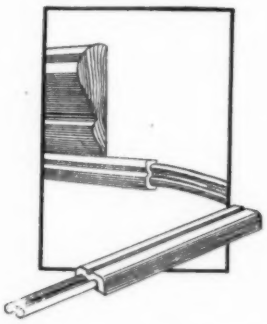

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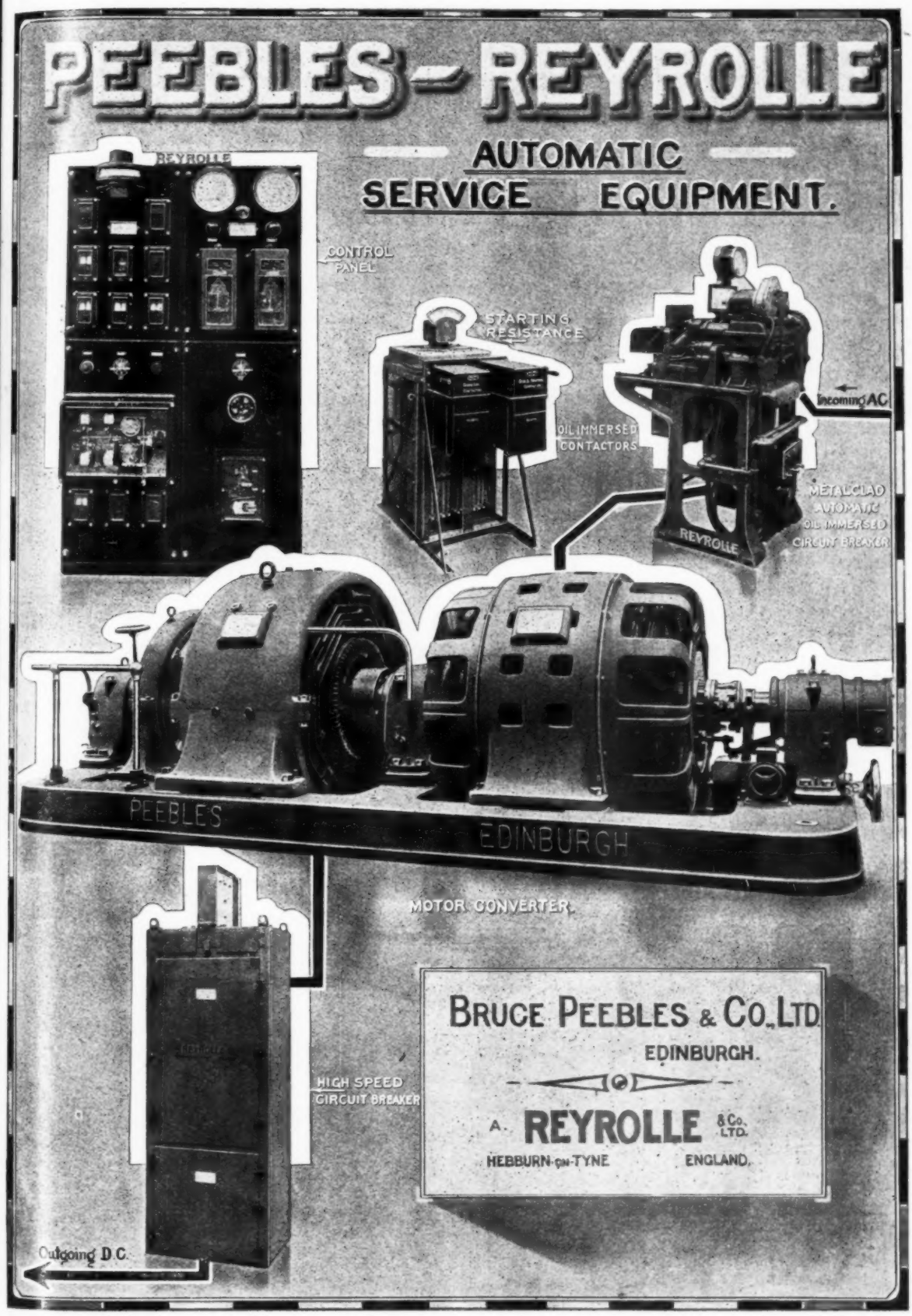

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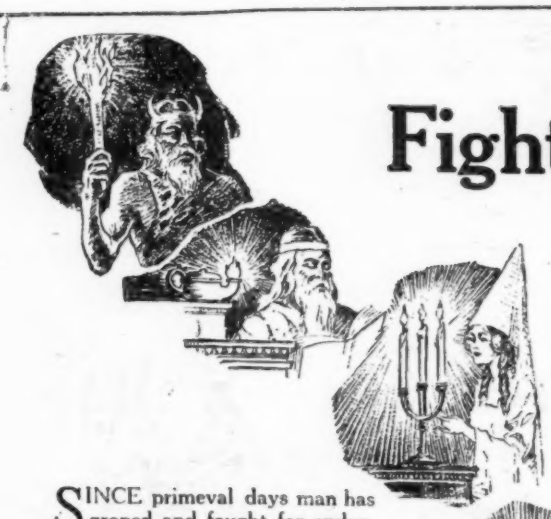

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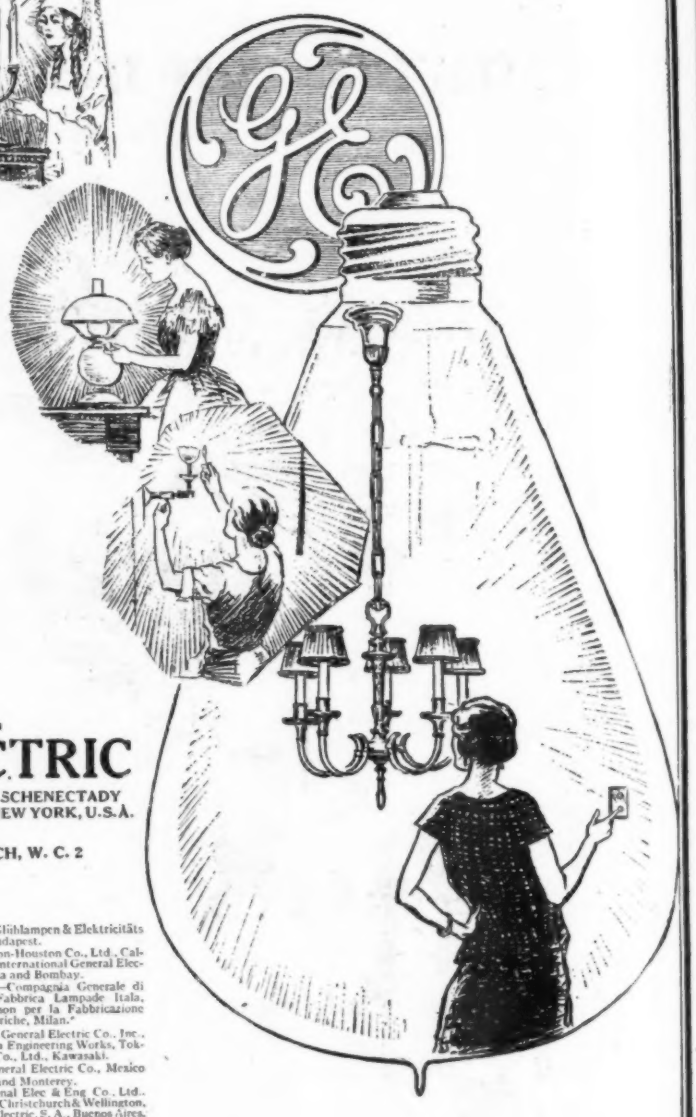

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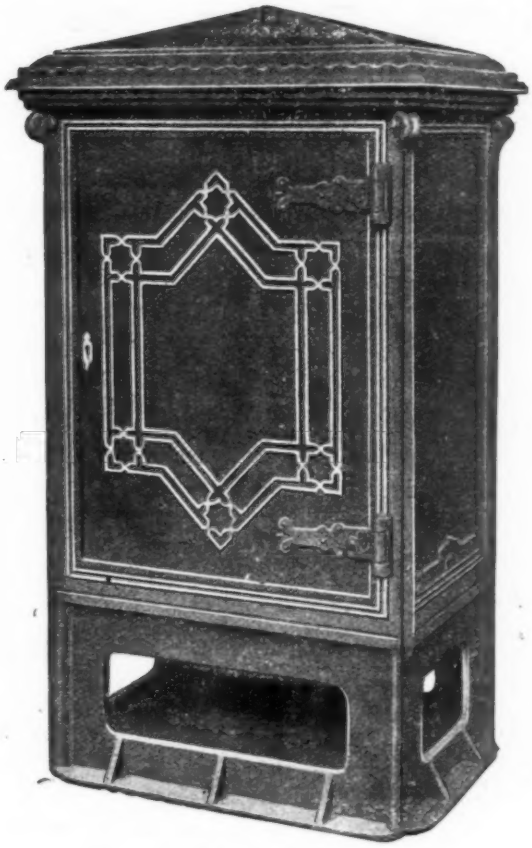

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„ 2a ...	21 × 16 ins. ...	33 × 17 ins.	
„ 2c ...	21 × 18 ins. ...	33 × 17 ins.	46½ ins.
„ 2b ...	25 × 14 ins. ...	36 × 21 ins.	
„ 3 ...	25 × 16 ins. ...	36 × 21 ins.	49 ins.
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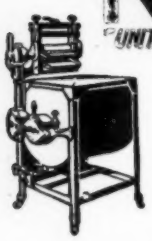

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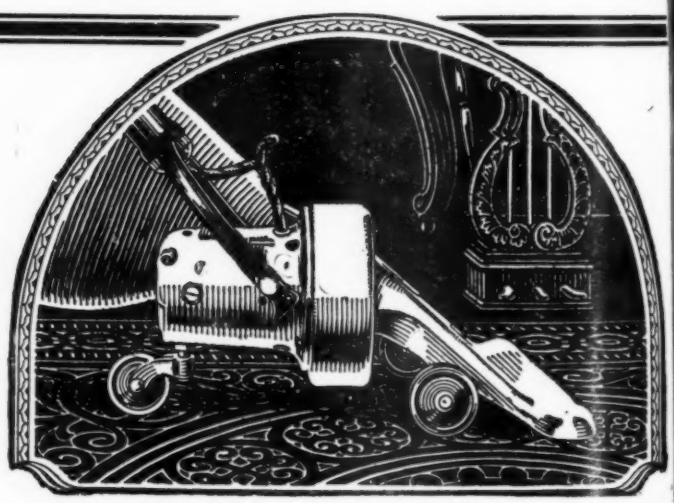

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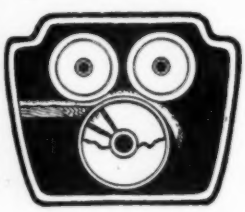

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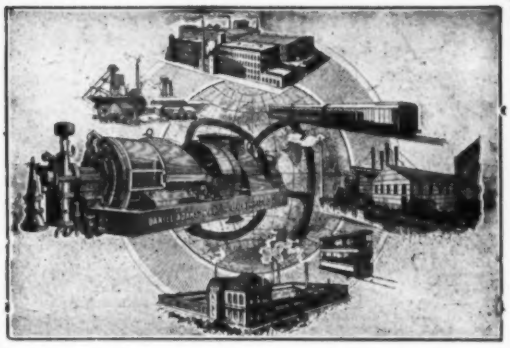

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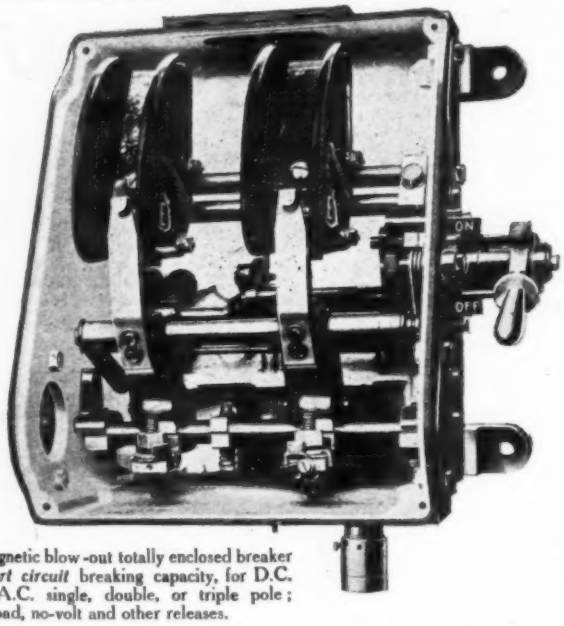

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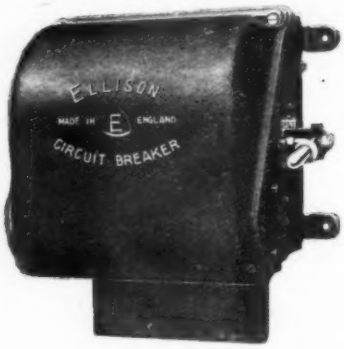

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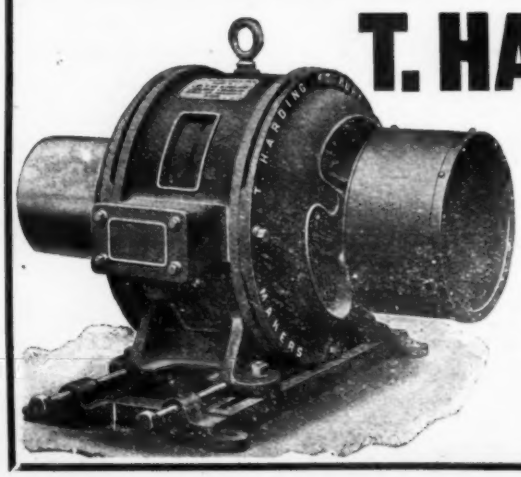

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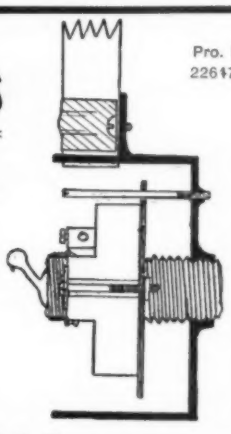

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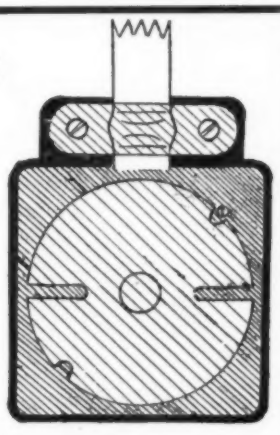

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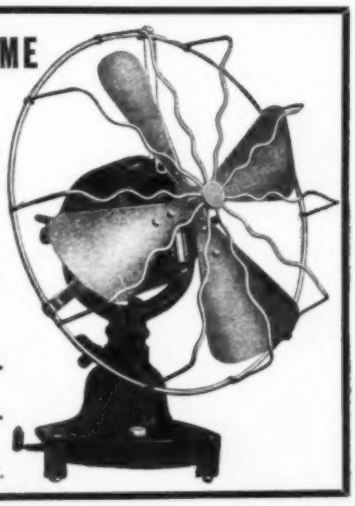

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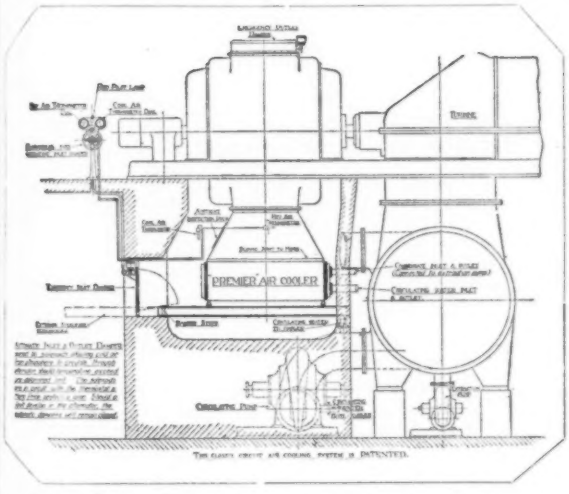

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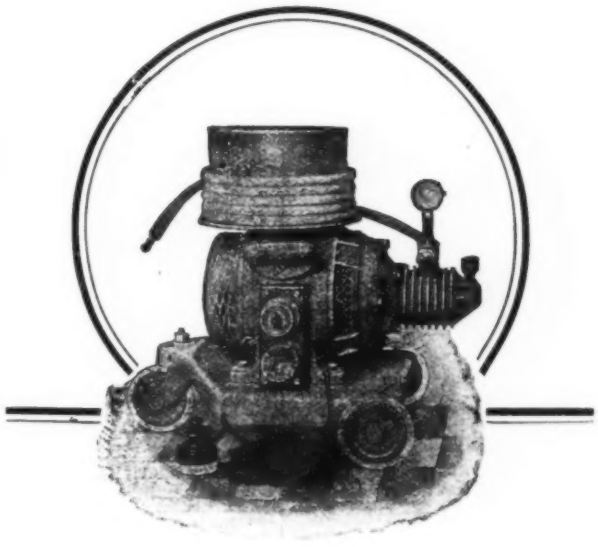

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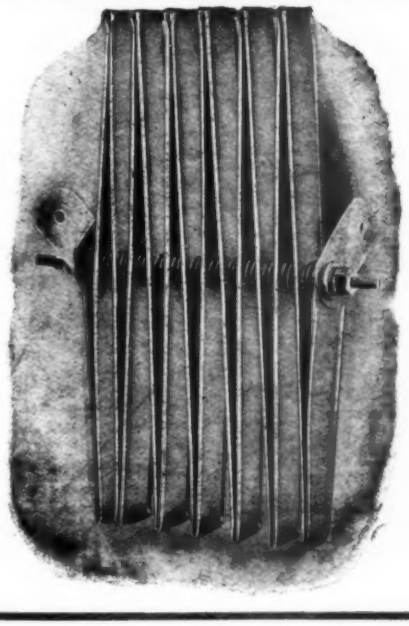

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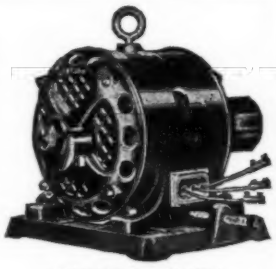

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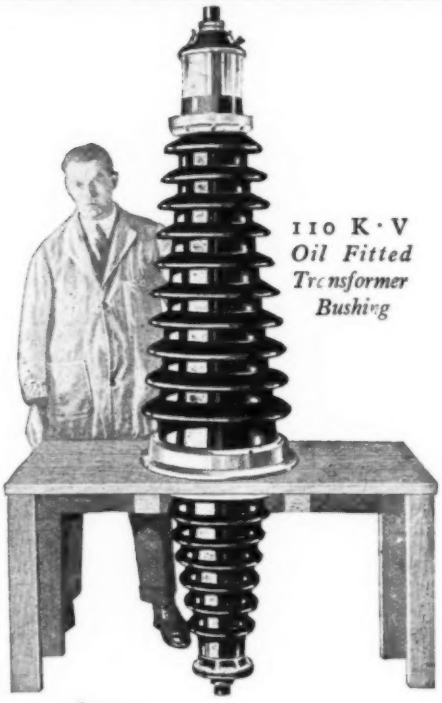

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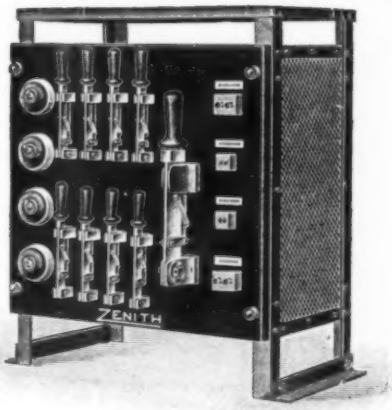

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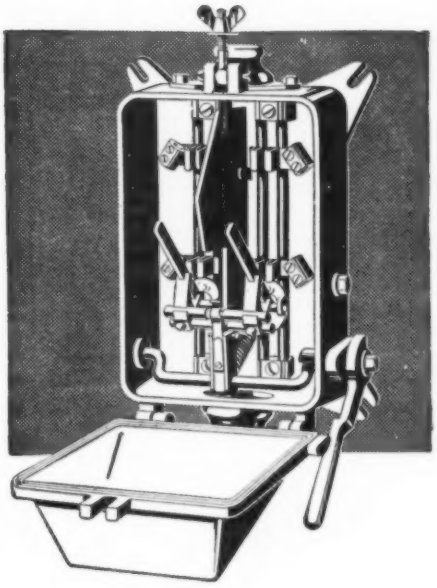

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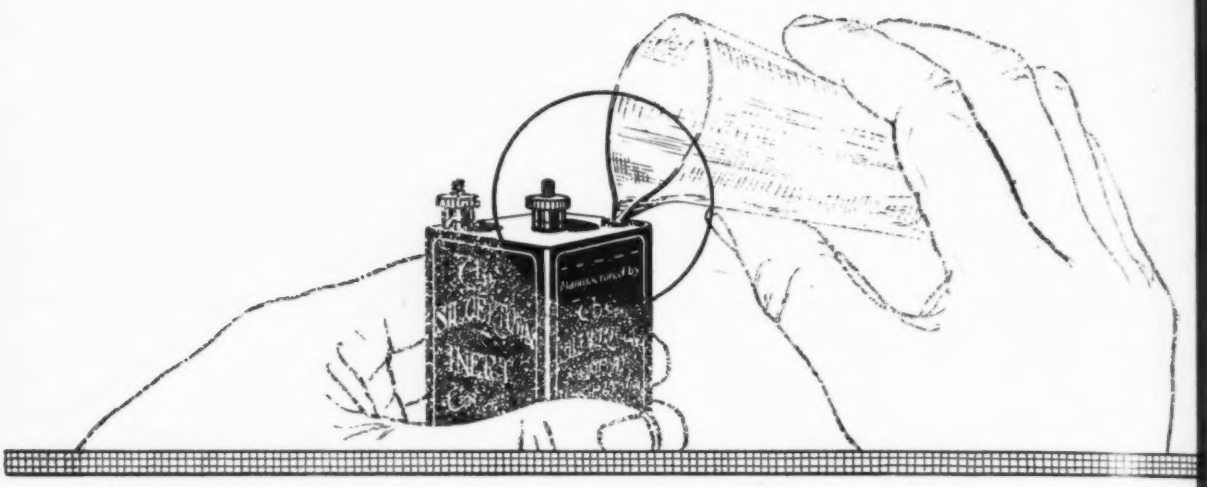

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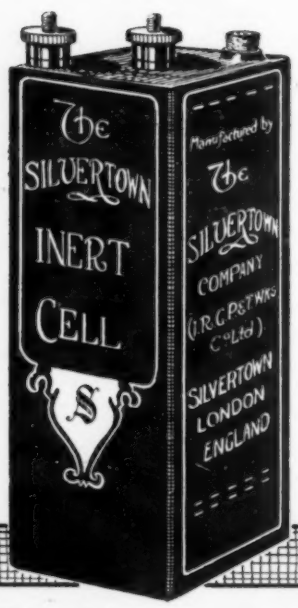

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